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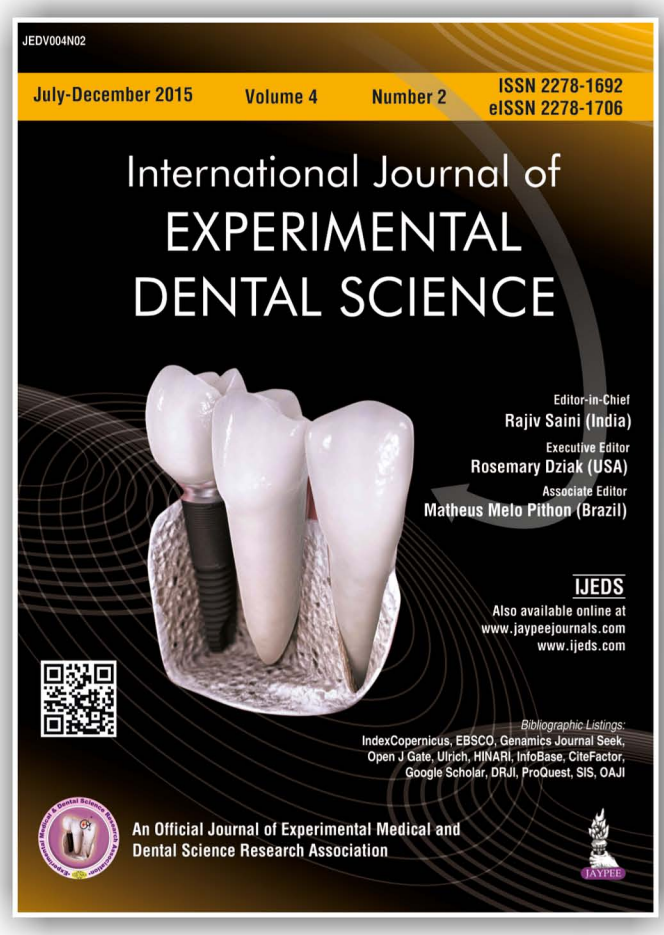

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Journal of Contemporary Dentistry

1. Aims and Scope

The Scientific Journal of the Mahatma Gandhi Mission Dental College was launched in June 2011.

This journal is dedicated to increasing scientific exchange across college departments and to encourage postgraduates, staff and students to be involved in scientific literary work.

This journal also endeavors to promote a multidisciplinary outlook in dentistry. This journal publishes evidence-based original scientific articles presenting relevant and useful information to all dentists. Additionally, it publishes case reports of innovative techniques, new instructional methodologies and instructive clinical reports with an interdisciplinary flair.

The journal is particularly focused on promoting and positioning the scientific edge of this institution to the outside world.

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Editorial

Eco-friendly Dentistry

This issue of the journal saw a clamor of research work by postgraduates; it is always a pleasure to publish an encourage research undertaken by students. Research always is the backbone to any scientific endeavor. As my mind meandered in the area, I was wondering about one area of research or focus for the future and that would be "greener" dentistry; the reduce, reuse, recycle mantra would focus more on dentistry in the years to come. It has been said that it is not possible to have healthy people on a sick planet. Reducing waste, changing patterns of consumption, and limiting the amount of adverse chemicals entering the breathable air of a dental office are achievable and realistic goals for the future. For this reason, more research is needed to find cost-effective environmental alternatives in dentistry.

Minimizing your environmental footprint is a positive trend occurring within dentistry with the adoption of environmentally friendly strategies. These strategies would include the selection and use of products that are biodegradable and have less toxic byproducts, such as volatile organic compounds (VOCs) or replacing disposable items that can be reused, recycling used dental instruments, reducing water and energy consumption, choosing products that consume fewer resources to manufacture, and recycling waste from the dental practice. Manufacturers also have initiated strategies to provide products that are more eco-friendly. Dentists should take a leading role in society by implementing "green" initiatives to lessen their impact on the environment by following "green" recommendations.

Some green recommendations are using disposable, plastic/paper barriers only as truly needed; reusable cups instead of paper cups, cloth operatory, and sterilization methods instead of disposables, reusable metal instead of plastic suction tips, tooth-colored instead of silver amalgam restorations thus reduction of mercury and other heavy metals into water system; energy-saving measures such as energy-saving light bulbs and motion sensors and light-emitting diode operatory lighting and use fluorescent instead of halogen lighting, where practical and finally use of liquid-crystal display instead of cathode ray tube computer screens. Use of hand sanitizer instead of handwashing when appropriate and turning off the water while lathering when handwashing is required helps conserve water. US dental offices dispose 48 million lead foils each year and the chemical fixers and lead foils from X-ray processes have to go somewhere, which often means public sewer systems; so, switching to digital imaging helps a great deal.

So, as one can see, there is tremendous scope to turning a "green" dentist and thus conserving our planet. As Paul Hawken beautifully put it "The ultimate purpose of business is not, or should not be, simply to make money. The promise of business is to increase the general well-being of humankind through service, a creative invention and ethical philosophy."

Richard Pereira
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RESEARCH ARTICLE

Comparative Evaluation of Microroughness created on Titanium Alloy for Use in Dental Implants subjected to Two Different Acid Etching Techniques: An *in vitro* Study

[1]Vishwas Updesh Madaan, [2]Manjeet Mapara, [3]Ashvini M Padhye

ABSTRACT

Aim: The aim of this study was to comparatively evaluate the microroughness created on titanium alloy for use in dental implants subjected to two different acid etching techniques.

Materials and methods: Commercially available grade 5 pure titanium plates were machine prepared into 26 plates measuring 3 cm × 1 cm × 5 mm for acid etching with hydrofluoric acid (HF) and dual acid etching technique using sulfuric acid (H_2SO_4) followed by hydrochloric acid (HCl). Twenty-five plates were divided into four groups based on the duration and sequence of acid etching. Upon completion of the acid etching procedure, the titanium plates were assessed for their surface characteristics by a surface profilometer. The average roughness parameters values Ra, Rq, Rz obtained for each titanium plate were compared against each other and with unetched titanium plate.

Results: The average roughness value Ra obtained was 0.480 µm for untreated surface and 3.65 µm maximum for the titanium plate etched for 72 hours in H_2SO_4 and 48 hours in HCl, which is about seven times the value of surface roughness on the unetched plates. The roughness values obtained after acid etching with HF for any duration were nonsignificant compared with the unetched plates.

Conclusion: The dual acid etching technique seems to be a simple method to develop a titanium implant surface, though evaluation of the biological response to this surface is necessary.

Clinical significance: The present study showed that by optimizing the parameters of acid etching, a rough titanium surface can be obtained similar to the various implant surfaces available commercially.

Keywords: Acid etching, Dental implant, Profilometer, Surface topography.

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INTRODUCTION

Osseointegration consists of a series of bone modeling and remodeling processes. It has actually been defined as the direct structural and functional connection between living bone and the surface of a load-bearing artificial implant. The success of osseointegration depends on the quality, distribution, and amount of bone present at the site of the dental implant.[1] The nature of the implant surface has been recognized to be a critical factor for osseointegration. The most important surface properties are topography, chemistry, surface charge, and wettability.[2] Endosseous dental implants are available with various surface characteristics ranging from relatively smooth-machine surfaces to more roughened surfaces by coating, blasting by various methods, by acid treatments or by a combination of the treatments.[3] Response of the tissues to the implant is largely controlled by the nature and texture of the surface of the implant.[4] Some of these have the ability to enhance and direct the growth of bone and achieve osseointegration when implanted in osseous sites.

Altering the surface topography of an implant can greatly improve its stability.[5] Based on the scale of the features, the surface roughness of implants can be divided into macro-, micro-, and nano-sized topologies.[6] Surface irregularities of an implant can be designed by making porous and/or by coating the implant surface with other suitable materials to increase bone–implant contact, as the anatomic surface of bone cannot be controlled.[7]

Surface irregularities can be produced through ablative/subtractive procedures or additive procedures.

Ablative procedures	Additive procedures
• Grit blasting	Plasma spraying
• Acid etching	Electrophoretic deposition
• Shot/Laser peening	Sputter deposition
	Sol Gel coating
	Anodizing
	Pulsed laser deposition
	Biomimetic precipitation

Modifications of the implant surface features an increase in retention between the implant and the bone by enlarging the contact surface, increasing the biomechanical interlocking between implant and bone, and by enhancing osteoblast activity with quicker formation of bone at the interface. [8]

Acid etching appears to greatly enhance the potential for osseointegration especially in the earliest stages of periimplant bone healing. Also with this technique, there is no need for any external agent that contaminates the implant surface. Acid treatment produces a clean, highly detailed surface texture and lacks entrapped surface material and impurities. This has been reported to have a positive effect on the biologic response in terms of bone apposition, a higher percentage of direct bone to implant contact, and strong implant anchorage.[9] Studies demonstrated[10-13] that optimal surface roughness of particles of 75 µm made surface more resistant to torque and greater bone to metal contact than small (25 µm) or coarse (250 µm) particles. Also, precise acid selection and the sequence of processing played the main role in preparation of the rough titanium surface. The surfaces were poorer if they were etched with hydrochloric acid (HCl) than with sulfuric acid (H_2SO_4). The sequence of H_2SO_4 followed by HCl showed the best results, and as the acid-etched texture is contiguous with the porous coating, there is no possibility of debonding or dissolution, thus avoiding concerns with third body wear particles or long-term fixation.[10]

Aim

The aim of this study was to comparatively evaluate the microroughness created on titanium alloy for use in dental implants subjected to two different acid etching techniques.

Objectives

The objectives of this study are as follows:

- To evaluate the suitability and handling characteristics of hydrofluoric acid for obtaining a titanium surface suitable for use in dental implants.
- To evaluate the suitability of application of dual acid etching technique with H_2SO_4 and HCl at varying time intervals for obtaining a titanium surface suitable for use in dental implants.
- To identify the technique that yields minimum and maximum surface roughness as measured by a surface profilometer.
- To evaluate and compare the surface characteristics of etched and unetched titanium plates with the help of a surface profilometer.
- To develop a technique of acid etching using a combination of two acids that yields a surface roughness similar to the commercially available dental implants.

MATERIALS AND METHODS

Acid Etching Procedure

Commercially available pure titanium Grade 5 sheet was machine prepared to form 26 plates measuring 3 cm x 1 cm x 5 mm each. One plate T_0 was left unetched; the rest of 25 plates that were to be subjected to acid etching were divided into four groups (Group I - H_2SO_4 72 hours, Group II - H_2SO_4 66 hours, Group III - H_2SO_4 88 hours, Group IV - HF) based on the duration of exposure to H_2SO_4 and numbered from T1 to T13 based on the duration of exposure to HCl, which varied from 18 to 48 hours as follows:

T_0: Unetched plates

- T1: H_2SO_4 72 hrs – HCl 18 hrs
- T2: H_2SO_4 72 hrs – HCl 24 hrs
- T3: H_2SO_4 72 hrs – HCl 30 hrs
- T4: H_2SO_4 72 hrs – HCl 36 hrs
- T5: H_2SO_4 72 hrs – HCl 48 hrs

} Group I

- T6: H_2SO_4 66 hrs – HCl 24 hrs
- T7: H_2SO_4 66 hrs – HCl 30 hrs
- T8: H_2SO_4 66 hrs – HCl 36 hrs
- T9: H_2SO_4 66 hrs – HCl 48 hrs

} Group II

- T10: H_2SO_4 88 hrs – HCl 24 hrs
- T11: H_2SO_4 88 hrs – HCl 30 hrs
- T12: H_2SO_4 88 hrs – HCl 36 hrs
- T13: H_2SO_4 88 hrs – HCl 48 hrs

} Group III

Based on the duration of exposure to HF acid (40%), the titanium plates were numbered from T14 to T25 as follows:

- T14: HF 15 secs
- T15: HF 30 secs
- T16: HF 45 secs
- T17: HF 60 secs
- T 18 : HF 75 secs
- T 19 : HF 90 secs
- T 20 : HF 105 secs
- T 21 : HF 120 secs
- T 22 : HF 135 secs
- T 23 : HF 150 secs
- T 24 : HF 165 secs
- T 25 : HF 180 secs

} Group IV

A groove was prepared on one side of every plate with a straight fissure diamond bur and air-rotor to identify the side on which the roughness measurement will be made after acid etching. All procedures of acid etching were performed in a certified fume hood[1] available at MGM Central Research Laboratory.

[1]LabGuard technologies Fume Hood Maxima

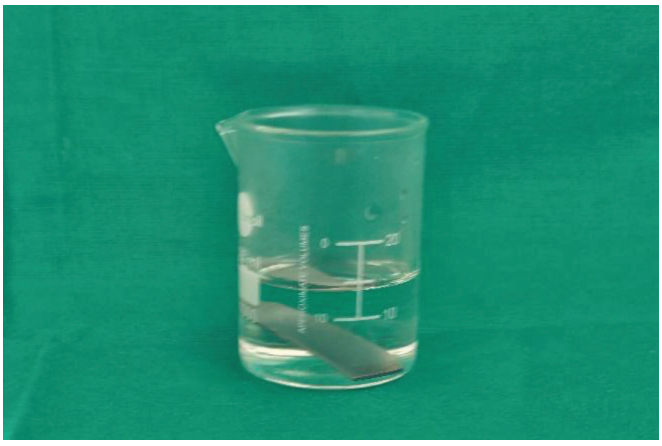


Fig. 1: Acid etching of titanium plate

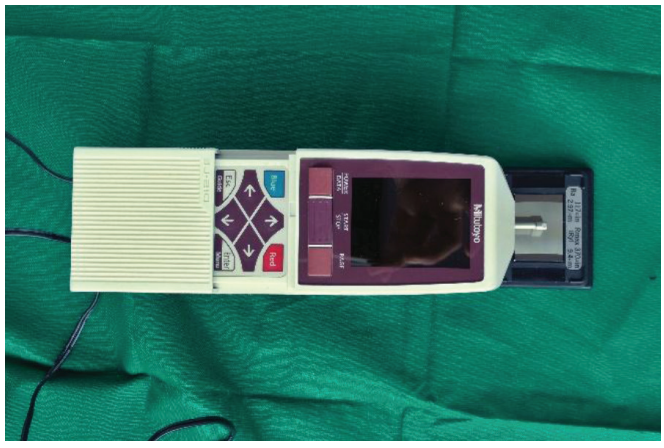


Fig. 2: Mitutoyo 178-561-02A Surftest SJ-210 surface profilometer

The plates numbered T1-T13 were kept angulated in 25-ml borosilicate glass beakers such that only top and bottom edge of the plate touched the beaker, and the acid H_2SO_4 (98%) (Fig. 1) was poured along the side of the beaker until the top edge of the titanium plate was completely immersed in the acid. These plates were then divided into three groups. Group 1 was exposed to H_2SO_4 for 72 hours, Group 2 was exposed to H_2SO_4 for 66 hours, and Group 3 was exposed to H_2SO_4 for 88 hours.

The beakers were kept untouched till the specified time as cited previously for each specimen. All T1-T13 plates were removed with tweezers washed in an ultrasonic bath with distilled water for 1 minute and kept in another beaker to be filled with HCl (35–38%). Plates in Group 1 were subjected to HCl for 18, 24, 30, 36, and 48 hours, and plates in Group 2 and Group 3 were subjected to HCl for 24, 30, 36, and 48 hours.

The plates numbered T14-T25 were immersed in the previously filled teflon beaker containing HF (40%) for 15 to 180 seconds at every 15-second intervals.

Upon completion of the acid etching procedure, the titanium plates were held from the sides with a tweezer and rinsed with distilled water, dried and kept in air-tight plastic bags until further evaluation.

Topographical Evaluation of Titanium Plates

All 26 titanium plates were assessed for their surface characteristics by a Mitutoyo 178-561-02A Surftest SJ-210 surface profilometer[2] calibrated (Fig. 2) according to the manufacturer's instructions.

The marked surface of the plates was kept facing upwards on a flat surface parallel to the floor. The recording head of the surface profilometer was kept at a distance of 5 mm from the side edge and 1 cm from the top of the plate to record the roughness measurements in a linear distance of 5 mm (Fig.3).

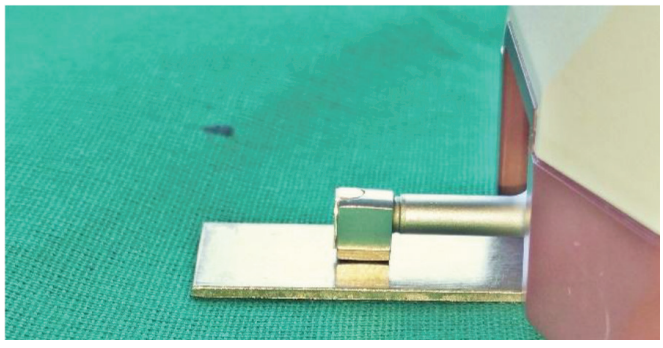


Fig. 3: Measuring the surface roughness of titanium plate using surface profilometer

The following variables of roughness were obtained for each plate:

- Roughness parameters (DIN EN ISO 4287:1998)
- Ra – Arithmetic mean surface roughness: Arithmetical mean of the sums of all profile values in a given linear sample.
- Rq – Root mean square of the Ra values; it is a value characteristic of a continuously varying quantity.
- Rz - Average distance between the highest peak and lowest valley in each sampling length.

Three measurements were performed for each specimen according to ISO 4287: 1997.

The arithmetic mean deviation of the profile (Ra) and the maximum height (Rz) were measured with a cut-off value of 0.8 mm, measurement length of 5 mm, measurement speed of 0.6 mm/s, and a Gaussian filter.

Statistical Analyses

Statistical analyses were performed using the SPSS/ PC+ version 17.1 program (SPSS Inc., Chicago, Illinois, USA). The means and standard deviations of data were calculated. Shapiro-Wilk's test was done to find distribution of data. One-way analysis of variance (ANOVA) with Duncan's multiple comparisons test was performed to

[2]Mitutoyo 178-561-02A Surftest SJ-210 Surface Roughness Tester

evaluate differences between groups. Values of p less than 0.05 were considered statistically significant.

RESULTS

The average roughness values Ra, Rq, Rz evaluated, for untreated and acid etched samples, are reported in Tables 1, 2, and 3 respectively.

The characterization of the implant surfaces carried out by roughness profilometer showed different aspects in the topographies of the surfaces of titanium plates due to the different duration and combination of acids used in the etching process.

From Table 1, it is clear that the roughness value of titanium surfaces increased after various surface treatments. From the experiment, the average roughness value Ra obtained is 0.480 µm for untreated surface and 3.65 µm maximum for the T5 titanium plate after 72 hours of H_2SO_4 and 48 hours of HCl etching, which is about seven times the base value of the unetched surface.

Test for normality of distribution of data was performed using Shapiro-Wilk's test. The data were found to be normally distributed; hence, we used ANOVA to compare in between the groups (Table 4).

Table 1: Ra values for T1-T13

Unetched	*T0*	*0.418*	*0.528*	*0.484*	*0.480*
Groups	*Groups*	*Ra-1*	*Ra-2*	*Ra-3*	*Average*
72/18	T1	1.08	1.291	0.927	1.10
72/24	T2	0.847	0.843	0.843	0.84
72/30	T3	3.328	3.244	2.918	3.16
72/36	T4	0.708	0.721	0.758	0.73
72/48	T5	3.732	3.729	3.489	3.65
66/24	T6	1.338	0.93	0.741	1.00
66/30	T7	0.632	0.794	0.74	0.72
66/36	T8	2.093	1.387	0.971	1.48
66/48	T9	0.813	1.15	0.762	0.91
88/24	T10	0.915	0.903	0.809	0.88
88/30	T11	1.764	1.845	1.767	1.79
88/36	T12	2.743	2.158	2.874	2.59
88/48	T13	3.093	3.16	3.181	3.14

Table 2: Rq values for T1-T13

Unetched	*T0*	*0.609*	*0.622*	*0.601*	*0.612*
Groups	*Groups*	*Rq-1*	*Rq-2*	*Rq-3*	*Average*
72/18	T1	1.361	1.648	1.162	1.39
72/24	T2	1.063	1.045	1.055	1.05
72/30	T3	3.966	3.831	3.908	3.90
72/36	T4	0.896	0.911	0.973	0.93
72/48	T5	4.407	4.954	5.312	4.89
66/24	T6	1.683	1.169	0.93	1.26
66/30	T7	0.802	0.999	0.93	0.91
66/36	T8	2.611	1.735	1.213	1.85
66/48	T9	1.012	1.438	0.96	1.14
88/24	T10	1.137	1.117	0.994	1.08
88/30	T11	2.278	2.355	2.225	2.29
88/36	T12	3.424	2.742	3.703	3.29
88/48	T13	3.882	3.81	3.977	3.89

Table 3: Rz values for T1-T13

Unetched	*T0*	*3.336*	*3.342*	*3.426*	*3.394*
Groups	*Groups*	*Rz-1*	*Rz-2*	*Rz-3*	*Average*
72/18	T1	7.851	9.471	6.849	8.06
72/24	T2	6.278	6.255	6.321	6.28
72/30	T3	18.092	18.109	24.927	20.38
72/36	T4	5.523	5.586	6.293	5.80
72/48	T5	23.711	24	26.91	24.87
66/24	T6	10.038	5.996	5.426	7.15
66/30	T7	5.319	5.818	5.519	5.55
66/36	T8	13.218	9.091	7.447	9.92
66/48	T9	6.151	7.578	5.982	6.57
88/24	T10	6.305	6.107	5.396	5.94
88/30	T11	11.894	14.267	12.673	12.94
88/36	T12	19.238	16.784	20.011	18.68
88/48	T13	19.875	19.813	20.305	20.00

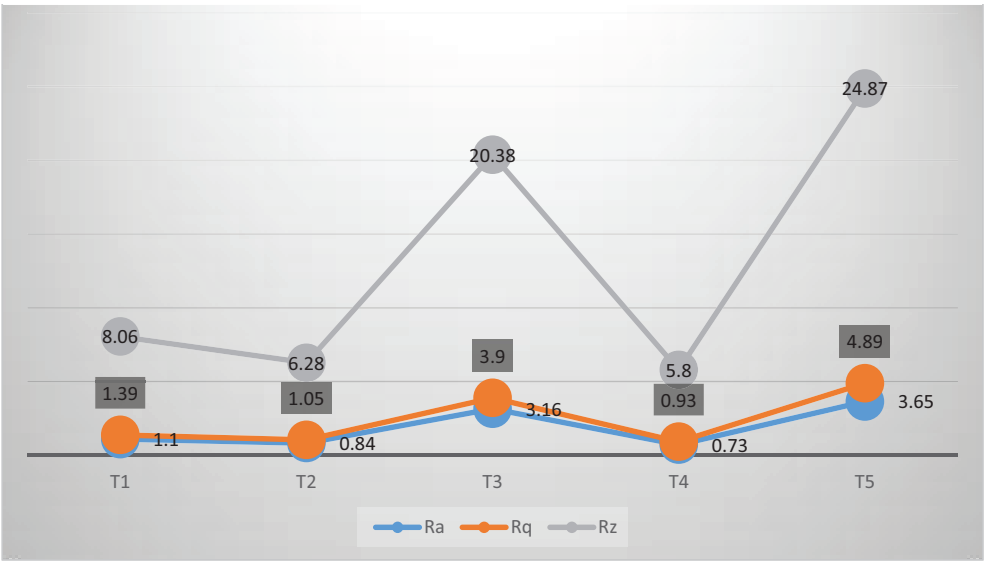
Table 4: Descriptive statistics

	Ra		*Rq*		*Rz*	
	Mean	*Standard deviation*	*Mean*	*Standard deviation*	*Mean*	*Standard deviation*
T1	1.10	0.18	1.39	0.24	8.06	1.32
T2	0.84	0.00	1.05	0.01	6.28	0.03
T3	3.16	0.22	3.90	0.07	20.38	3.94
T4	0.73	0.03	0.93	0.04	5.80	0.43
T5	3.65	0.14	4.89	0.46	24.87	1.77
T6	1.00	0.31	1.26	0.38	7.15	2.51
T7	0.72	0.08	.91	0.10	5.55	0.25
T8	1.48	0.57	1.85	0.71	9.92	2.97
T9	0.91	0.21	1.14	0.26	6.57	0.88
T10	0.88	0.06	1.08	0.08	5.94	0.48
T11	1.79	0.05	2.29	0.07	12.94	1.21
T12	2.59	0.38	3.29	0.49	18.68	1.68
T13	3.14	0.05	3.89	0.08	20.00	0.27

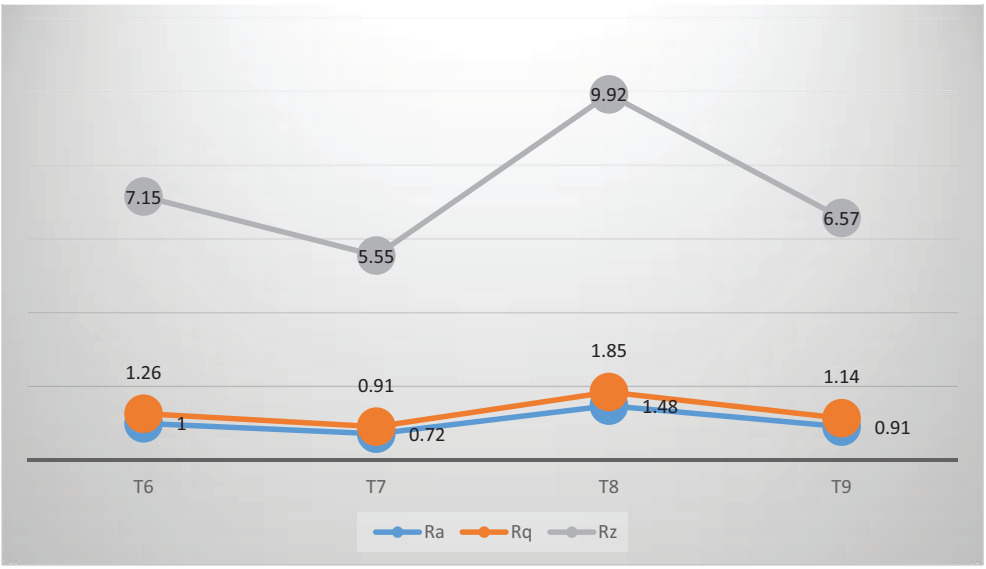
Graph 1 shows the changes in roughness parameters in Group 1 when H_2SO_4 was kept constant at 72 hours and duration in HCl was varied from 18, 24, 30, 36, and 48 hours. Analyzing the trend of Ra values, one can appreciate that the average depth of the grooves of the new roughened microsurface increased sharply when plates were etched for 36 and 48 hours in HCl.

Graph 2 shows the roughness parameters in Group 2 when H_2SO_4 was kept constant at 66 hours and duration in HCl varied from 24, 30, 36, and 48 hours. The roughness values in this group were lesser than Group I, indicating that H_2SO_4 exposure at 66 hours was weaker and less significant for creating microroughness on the titanium surface.

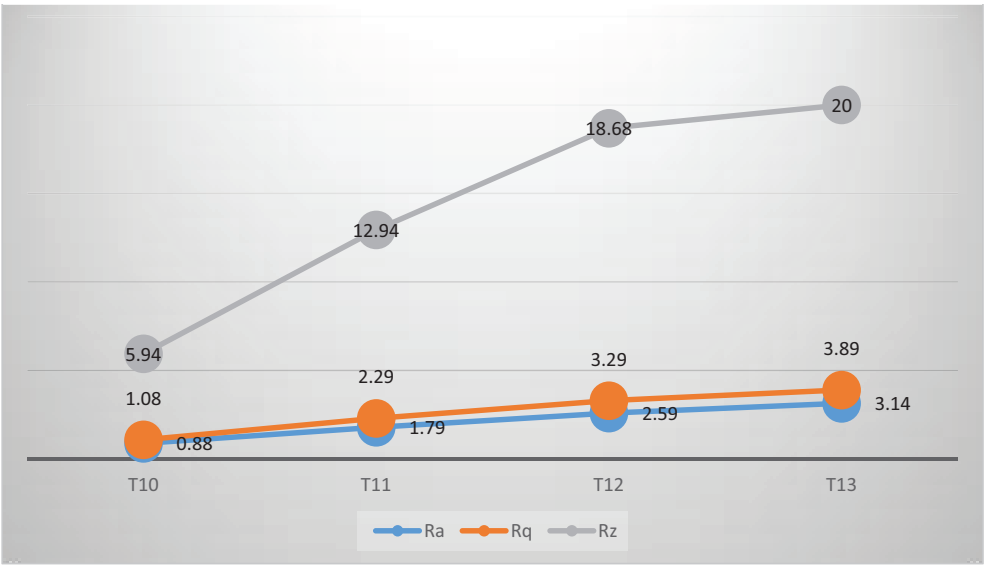
Graph 3 shows the roughness values in Group III when H_2SO_4 was kept at 88 hours and HCl was varied from 24, 30, 36, and 48 hours. Analyzing the trend of roughness parameter in this group indicated that as the



Graph 1: H_2SO_4 72 hours



Graph 2: H_2SO_4 – 66 hours



Graph 3: H_2SO_4 – 88 hours

Table 5: Ra, Rq, Rz values for T14-T25

Unetched	*T0*	*0.418*	*0.528*	*0.484*
Groups	*Groups*	*Ra*	*Rq*	*Rz*
15	T14	0.565	0.852	3.566
30	T15	0.544	0.843	3.458
45	T16	0.526	1.115	3.918
60	T17	0.548	0.959	3.758
75	T18	0.432	0.729	3.489
90	T19	0.378	0.930	2.741
105	T20	0.342	0.794	2.074
120	T21	0.553	1.387	3.971
135	T22	0.513	1.15	3.762
150	T23	0.415	0.903	2.908
165	T24	0.364	0.845	2.967
180	T25	0.343	0.758	2.874

Table 6: Ra comparison with initial value = 0.48

	Test value = 0.48				
	t	*df*	*p*	*Mean difference*	*Interpretation*
T1	5.869	2	0.028	0.61933	Significant
T2	273.250	2	0.00001	0.36433	Significant
T3	21.460	2	0.002	2.68333	Significant
T4	16.625	2	0.004	0.24900	Significant
T5	39.377	2	0.001	3.17000	Significant
T6	2.969	2	0.097	0.52300	Nonsignificant
T7	5.082	2	0.037	0.24200	Significant
T8	3.065	2	0.092	1.00367	Nonsignificant
T9	3.519	2	0.072	0.42833	Nonsignificant
T10	11.806	2	0.007	0.39567	Significant
T11	49.483	2	0.00041	1.31200	Significant
T12	9.594	2	0.011	2.11167	Significant
T13	100.420	2	0.00010	2.66467	Significant

Interpretation criteria:
- p value less than that of 0.05 indicates significance of difference between the group mean and initial value, i.e., 0.48
- Lower the p value, more is the significance

duration of exposure was increased with HCl, the roughness increased considerably.

Table 5 summarizes the Ra, Rq, and Rz values of titanium plates numbered T14-T25, which were subjected to HF acid etching. These plates did not show any significant increase in the roughness values compared with the unetched titanium plates and dual etched plates.

Plates T_6, T_8, and T_9 did not show any significant change in roughness parameter Ra (Table 1) when compared with unetched plates. All three being from Group II indicating that exposure of titanium for 66 hours in H_2SO_4 did not yield a significantly rough surface (Table 6).

DISCUSSION

Osseointegration consists of a series of bone modeling and remodeling processes, which causes direct structural and functional connection between living bone and the surface of a load-bearing artificial implant. Barier et al[14] discussed the features that play the most significant role in early osseointegration and immobilization of the implant in the tissue bed. Texture, charge, and chemistry of the surface as well as cleanliness were considered to be the most important requirements for the implant material.[12] Predecki et al[16] observed rapid bone growth and good mechanical adherence with an implant that had an irregular surface. Based on the fact that the quality of osseointegration is directly related to the topography of dental implant surfaces, many techniques related to the modifications carried out on implant surfaces have been tested during the last 30 years. These tests take into account the principle that the topography of a rough surface presents an area for bone anchorage that is much larger than a smooth surface does.[14] Characteristics of titanium implant surfaces have been modified by additive methods (e.g., titanium plasma spray) or subtractive methods (e.g., blasting, acid etching) to increase the surface area and to alter its micro-topography or texture.[15]

Buser et al[19] showed that implants with sandblasted and acid-etched surfaces had higher bone to implant contact percentages than implants with titanium plasma sprayed surfaces. However, It should be emphasized that this titanium surface was gained using two methods of processing-sandblasting and acid etching.

A new surface treatment that produces a microroughness similar to the blasted/etched surface but uses only special dual acid etching without grit blasting has been developed. The purpose of this dual etching is to produce a micro-rough surface that provides rapid osseointegration, while maintaining the long-term success associated with a machined implant surface.[17]

In the present study, two methods of surface treatments, namely, dual acid ethcing that was performed using H_2SO_4 (98%) and HCl (35-38%), in sequence, for time durations ranging from 66, 72, 88 hours for H_2SO_4 and 18, 24, 36, 48 hours for HCl, and etching with HF acid for time duration ranging from 15 to 180 seconds, to create a surface topography on titanium that encorporates all the surface features in the aforementioned studies, and comparatively analyzed the resultant surface with the unetched titanium plates, using a surface profilometer. This was done to minimize the cost of surface treatment and to simplify the process.

The present study showed that precise acid selection, time, and the sequence of processing was the most crucial step in obtaining roughened titanium surface, which was in accordance with the study carried out by David Baker and co-workers,[18] who determined that the dual etched surfaces using H_2SO_4 and HCl achieved higher roughness values and higher level of bone implant contact percentages. In a study by Buser et al, comparing

influence of different surface characteristics on bone integration of titanium implants found highest extent of bone-implant interface in sandblasted (large grit) and acid etched HCl + H_2SO_4 group with mean values of 50-60%.[19]

Profilometer readings were used to determine the surface irregularities of unetched and etched titanium plates in this study. Generally, the surface characteristics of implant surfaces are compared using scanning electron microscopic examination or profilometer reading. Scanning electron microscopic examination studies are qualitative tests that reveal scratches produced on a surface.[21] Profilometer results provide quantitative recording of surface irregularities. The profilometer is a device that uses a diamond stylus of precise dimensions to trace a fixed linear distance over the surface of the prepared sample. The profilometer produces a tracing and, using digital and analog hardware and software, also calculates the average surface roughness (Ra value) for the resultant tracing.

In this study, the following parameters for quantifying surface roughness were obtained for each plate:

- Roughness parameters (DIN EN ISO 4287:1998)[22]
- Ra – Arithmetic mean surface roughness: Arithmetical mean of the sums of all profile values in a given linear sample.
- Rq – Root mean square of the Ra values; it is a value characteristic of a continuously varying quantity.
- Rz - Average distance between the highest peak and lowest valley in each sampling length.

In the present study, the surface characterization of the titanium surfaces evaluated by surface profilometer showed different aspects in the topographies of the surfaces of titanium plates due to the different duration of acids used in the etching process. The average roughness value Ra obtained is 0.480 µm for untreated surface and 3.65 µm maximum for the T5 titanium plate after 72 hours of H_2SO_4 and 48 hours of HCl etching, which is about seven times the base value of the unetched surface. The average roughness values Ra for etched titanium plates ranging from 0.73 to 3.65 shows that acid etching was able to create micro-textured pits and waviness on the titanium surface, which was in accordance with the observations by Davies[11] who also showed that acid etching of titanium creates a micro-textured surface (fine rough surface with micropits of 1–3 µm and larger pits of approximately 6–10 µm) that appears to enhance early endosseous integration and stability of the implant. This may be related to a change in surface roughness and/or chemical composition.[23]

Another very important variable for determining the surface topography of titanium surface is Rz, which reveals the average distance between the highest peak and lowest valley in each sampling length. In this study, we found a wide range for the Rz values maximum in plate T5 (Rz = 24.87), which indicates that this surface had a very uneven waviness and distance between the crests and troughs was quite large, implying that the pits created after this sequence protocol were deepest compared with other plates. While comparing the surface of the etched titanium plates with the untetched titanium plates, we found that the surface roughness values for all plates were statistically significant except plate nos. T6, T8, T9, which belonged to the Group II (H_2SO_4 for 66 hours). Based on this observation, one can conclude that exposure of titanium surface to H_2SO_4 for 66 hours was not enough to significanlty alter the tianium surface from baseline.

The roughness values obtained after acid etching with HF acid did not show any significant improvement in surface characteristics compared with the unteched titanium plates. Moreover, the handling of HF was found to be cumbersome and caused time-dependent erosion of the titanium plates leading to severe loss in surface texture and weight at longer time durations above 60 seconds. These findings are in accordance with the results found by A. Thirugnanam et al also found nonsignificant results and loss of an average of 14% weight after acid etching of titanium surface with HF acid alone.[24] Thus from the findings of this study, we conclude that HF acid, used alone, was unsuitable at a concentration of 40%, to be used for acid etching of titanium plates, although microroughness obtained by the same is similar to the semi-polished unetched titanium plates and could be superimposed on macro roughness obtained by other means.

A study conducted to comparatively analyze the surface of four etched implants used the profile roughness measurements to characterize the surface of the four tested implants – DPS Frialit II, Osseotite, SLA-ITI, HaTi. The analyses showed that each implant surface displayed a distinct surface topography with Ra values ranging from 0.589 µm of osseotite implant to 2.455 µm of SLA-ITI implant, though all of them were found to be equally successful in osseointegration in clinical studies.[25] This observation implies that various acid etching techniques for obtaining surface roughness, though appear to be comparatively significant in *in vitro* studies, may not be superior clinically, and further biological, histomorphometric, and human trials are required to establish its effectiveness.

CONCLUSION

The specific dual acid etching technique using H_2SO_4 (98%) followed by HCl (35–38%) proposed in this experiment yields roughness parameters similar to the various implant surfaces available commercially when studied *in*

vitro. Etching of titanum plates with HF acid was found to be cumbersome and hazardous in the proposed setting and did not yield any significant enhancement of surface roughness compared with machine-prepared unetched plates. The present study showed that by optimizing the parameters of acid etching a rough titanium surface can be obtained similar to the various implant surfaces available commercially. Thus, dual acid etching seems to be a simple technique to develop a titanium implant surface, though evaluation of the biological response to this surface is necessary.

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RESEARCH ARTICLE

Alveolar Bone Dimensions of Mandibular Posterior Teeth using Cone Beam Computed Tomography: A Pilot Study

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ABSTRACT

Aim: The aim of this study was to analyze bone dimensions of the dentate posterior mandible using cone beam computed tomography (CBCT).

Objectives: The objectives of this study were
- To measure thickness of buccal and lingual bone walls in mandibular posterior teeth using CBCT.
- To measure alveolar bone width in mandibular posterior teeth using CBCT.

Materials and methods: Ten CBCT scans were included in the study (n = 65 teeth). Thicknesses of buccal and lingual walls were measured at MP1 and MP2. Alveolar width was assessed at most coronal detected alveolar bone (BW1) and at superior border of mandibular canal (BW2). Vertical distance between BW1 and BW2 was measured (H). Data were tabulated and results were statistically analyzed using unpaired *t* test.

Results: The study showed that there was an increase in bone wall thickness from 1st premolar to 2nd molar for buccal and lingual alveolar plates. Lingual bone walls were thicker than buccal bone walls at MP1 and MP2 for all teeth. Bone width for premolars was considerably less than bone width of molars.

Conclusion: Careful preoperative analysis using CBCT is important to assess need of bone augmentation procedures. As the bone thickness and width in the molar region is more adequate, prognosis of implants placed in molar region may be better.

Clinical significance: Analysis of bone dimensions is of utmost importance for successful outcome of bone augmentation procedures in implant treatment.

Keywords: Alveolar bone dimensions, CBCT, Implants Mandibular posterior teeth.

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INTRODUCTION

Implant treatment is a common procedure in dental practice. Immediate or early placement approach increases the attractiveness of implant therapy. After extraction, the alveolar process undergoes marked alterations because of which alveolar bone width and height of buccal bone changes significantly. Postextraction implant sites often require bone augmentation procedures to achieve and maintain successful osseointegration. Alveolar bone dimensions prior to extraction may be an important determinant of bone morphological changes that occur postextraction. Analysis of the dimensions may be important in formulating appropriate treatment plan.[1] Additionally, placement of immediate implants in fresh extraction sockets could prevent osseous changes that occur postextraction.[2] Clinical observations suggest that buccal bone resorption varies in magnitude among individuals and from site to site. Factors that affect this include the presence and absence of an infection, flap *vs* flapless extraction, traumatic extraction, and buccal bone wall thickness.[3] There is lingual bone concavity in mandibular posterior region owing to submandibular gland fossa. Dental implants in the region, if not placed properly, can perforate the lingual bone or damage the lingual nerve leading to treatment failure.[1]

Cone beam computed tomography (CBCT) is a promising diagnostic and prognostic tool in the implant therapy. It provides high resolution images of oral and maxillofacial region with lower radiation dose than conventional computed tomography.[1,4] It provides the clinician with third dimension that makes it better than two-dimensional imaging modalities such as intraoral periapical radiographs, orthopantomographs, etc.[5] Hence, it is imperative to evaluate bone dimensions of mandibular posterior teeth such as buccal and lingual bone plate thickness, alveolar bone width, and distance from the inferior alveolar canal using CBCT. The aim of this study was to evaluate thickness of buccal and lingual bone walls and width of the alveolus in patients undergoing implant therapy.

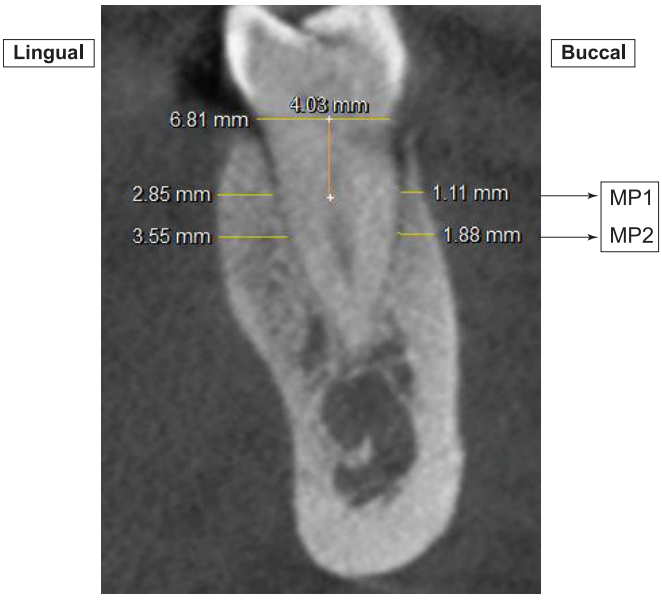
MATERIALS AND METHODS

This study included all the CBCT scans of patients who were referred for implant therapy to the Department of Oral Medicine and Radiology, MGV's KBH Dental College and Hospital, Nashik, Maharashtra, India. Clearance of the institutional ethical committee was taken. Machine used was SIRONA ORTHOPHOS XG 3D, Germany. Software used was Galileos viewer.

A total of 10 CBCT scans of which 65 teeth were included in the sample size. Data were reconstructed with slices of 1 mm thickness. Slice location passed through center of respective tooth parallel to the long axis of root that dictated vertical orientation of slice. Mesial and distal roots having different axes were analyzed differently.

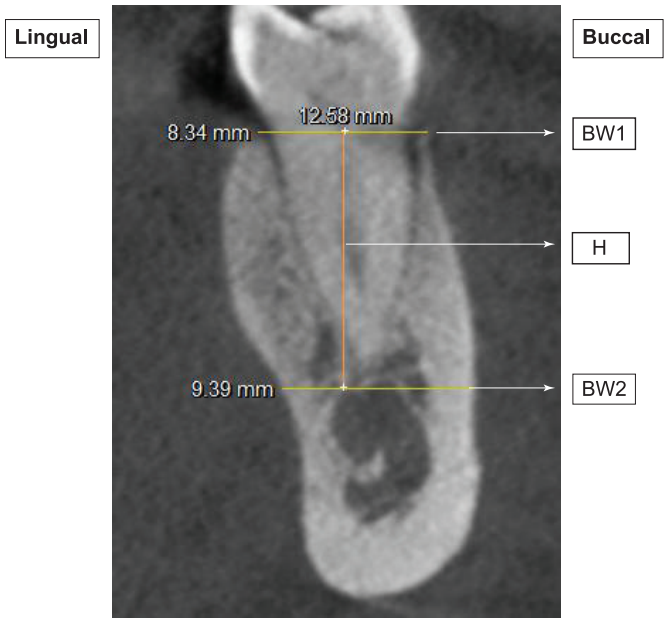
Teeth having periapical pathologies, which are indicated for apical surgery, were excluded from the study owing to the possible effects of periapical pathologies on alveolar bone dimensions at the analyzed sites. Patients with systemic diseases were excluded from the study. All other teeth were analyzed irrespective of their present pathology. Due to varying anatomy, third molars were not considered in the study.

Measurements were taken on cross-sectional view, which showed complete root and cementoenamel junction (CEJ). Thicknesses of buccal and lingual walls were measured on two locations on teeth, 4 mm apical to CEJ (MP1) and at the middle of the root (MP2) as shown in Figure 1. Alveolar crest width was measured at the most coronally detected buccal bone (BW1) and at the superior border of inferior alveolar canal (BW2). Vertical distance between BW1 and BW2 is measured as height (H) as depicted in Figure 2. Data were tabulated and analyzed



MP1—measurement point 1
MP2—measurement point 2

Fig. 1: Measurement of buccal and lingual bone wall thickness at MP1 and MP2



BW1—Bone width 1
BW2—Bone width 2
H—Height

Fig. 2: Measurement of height (H) and bone width (BW1 and BW2)

in Microsoft Excel. Minimum and maximum values for bone thickness and bone width were calculated. Median and mean was also calculated for the same. Unpaired *t* test at 95% confidence intervals and two-tailed was used.

RESULTS

Total sample size was 65 teeth. Distribution of teeth analyzed is depicted in Table 1.

Results of the study show that there was a gradual increase in bone wall thickness from 1st premolar to 2nd molar. At MP1, the range of mean value of buccal bone wall thickness was 0.431 to 1.786 mm from 1st premolar and 2nd molar respectively, as summarized in Table 2. At MP2, the range of mean value of buccal bone wall thickness was 0.862 to 3.63 mm from 1st premolar to 2nd molar respectively, as summarized in Table 3. Lingual bone wall thickness was considerably higher than buccal bone wall thickness at both MP1 and MP2. This difference was statistically significant for all teeth at MP1 as summarized in Table 4. It also shows a steady increase from a mean value of 1.611 to 2.86 mm at MP1 from 1st premolar to 2nd molar respectively. At MP2, lingual bone thickness values increased from 2.951 to 3.835 mm from 1st premolar to 2nd molar respectively. With exception of 2nd molar, difference between buccal and lingual bone walls at MP2 was statistically significant for all teeth as summarized in Table 5.

Table 1: Distribution of teeth analyzed

PM1	*PM2*	*M1*	*M2*	*Total*
17	18	14	16	65

PM1: 1st premolar, PM2: 2nd premolar, M1: 1st molar, M2: 2nd molar

Table 2: Thickness of buccal and lingual bone plates

		Minimum (mm)	*Median (mm)*	*Maximum (mm)*	*Mean (mm)*
PM1	Buccal	0	0.25	1.37	0.431
	Lingual	0	1.49	3.36	1.611
PM2	Buccal	0	0.5	1.37	0.437
	Lingual	0.74	1.87	3.47	1.976
M1M	Buccal	0.35	0.81	2.36	0.965
	Lingual	0.74	2.05	3.87	2.02
M1D	Buccal	0	0.775	1.63	0.73
	Lingual	1.36	2.615	3.36	2.411
M2M	Buccal	0	1.25	2.85	1.395
	Lingual	0.88	1.865	5.59	2.148
M2D	Buccal	0	1.19	4.83	1.786
	Lingual	1.12	2.68	5.59	2.86

AT MP1PM1: 1st premolar, PM2: 2nd premolar, M1M: Mesial root of 1st molar, M1D: distal root of 1st molar, M2M: Mesial root of 2nd molar, M2D: distal root of 2nd molar

Table 3: Thickness of buccal and lingual bone plates at MP2

		Minimum (mm)	*Median (mm)*	*Maximum (mm)*	*Mean (mm)*
PM1	Buccal	0	0.88	2.6	0.862
	Lingual	1.63	2.87	4.83	2.951
PM2	Buccal	0.37	1.125	3.47	1.373
	Lingual	0.87	2.98	4.35	3.001
M1M	Buccal	0.28	1.15	2.72	1.251
	Lingual	1.86	2.87	4.01	2.895
M1D	Buccal	0.51	1.305	2.6	1.451
	Lingual	2.66	3.855	5.59	3.94
M2M	Buccal	0.63	3.23	6.59	3.051
	Lingual	1.99	3.28	6.46	3.367
M2D	Buccal	1.14	3.23	7.34	3.63
	Lingual	2.23	3.635	6.46	3.835

Table 4: Dimensions of buccal and lingual bone walls of all teeth at MP1 (P < 0.05 significant)

MP1	*Buccal (mean ± SD) (mm)*	*Lingual (mean ± SD) (mm)*	*p-value*
PM1	0.43 ± 0.48	1.61 ± 0.96	<0.0001
PM2	0.44 ± 0.38	1.98 ± 0.82	<0.0001
M1M	0.87 ± 0.61	1.95 ± 0.82	0.0001
M1D	0.74 ± 0.63	2.41 ± 0.71	<0.0001
M2M	1.40 ± 0.91	2.15 ± 1.13	0.0467
M2D	1.79 ± 1.51	2.86 ± 1.23	0.0349

SD: Standard deviation

Table 5: Dimensions of buccal and lingual bone walls of all teeth at MP2 (P < 0.05 significant)

MP2	*Buccal (mean ± SD) (mm)*	*Lingual (mean ± SD) (mm)*	*p-value*
PM1	0.86 ± 0.76	2.95 ± 0.96	<0.0001
PM2	0.86 ± 0.76	1.37 ± 0.82	<0.0001
M1M	1.15 ± 0.64	2.87 ± 0.66	<0.0001
M1D	1.45 ± 0.66	3.94 ± 0.83	<0.0001
M2M	3.05 ± 1.67	3.36 ± 1.08	0.5289
M2D	3.63 ± 1.96	3.84 ± 1.20	0.7234

SD: Standard deviation

About 88.23% of 1st premolars and 88.89% of 2nd premolars showed very thin or no buccal bone wall (less than 1 mm) at MP1. About 41.17% of 1st premolars and 50% of 2nd premolars had lingual bone wall between 1 and 2 mm. About 29.41% of 1st premolars and 11.11% of 2nd premolars had lingual bone wall less than 1 mm at MP1, as depicted in Table 5. About 64.28% of 1st molars too had a buccal bone wall less than 1 mm at MP1 as shown in Graph 1 and Table 6. At MP2, 64.7% 1st premolars had thin or missing buccal bone walls. However, 93.75% of 2nd molars showed thicker lingual bone walls of more than 2 mm as shown in Graph 2 and Table 6.

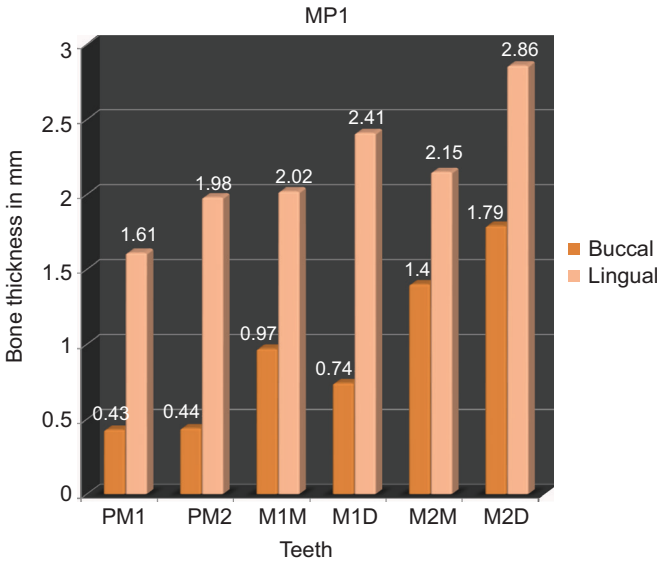
At the most coronally detectable alveolar bone BW1, mean bone width was 7.75 to 7.64 mm for premolars and 9.64 to 9.47 mm for molars. At BW2, bone width was 10.95 to 10.83 mm for premolars and 11.07 to 11.36 mm for molars. There was presence of lingual undercut that increased from 1st premolar to 2nd molar. Bone width values were considerably higher in molars than in premolars. Also, bone width increased from BW1 to BW2 as summarized in Table 7 and Graph 3. Difference between BW1 and BW2 is statistically significant for all teeth. BW1 values were considerably thinner than BW2 as summarized in Table 8. Vertical distance between BW1 and BW2 was measured (H), which shows distance of inferior alveolar bony canal from alveolar crest.

Table 6: Frequency distribution of teeth according to thickness of buccal and lingual walls (percentage)

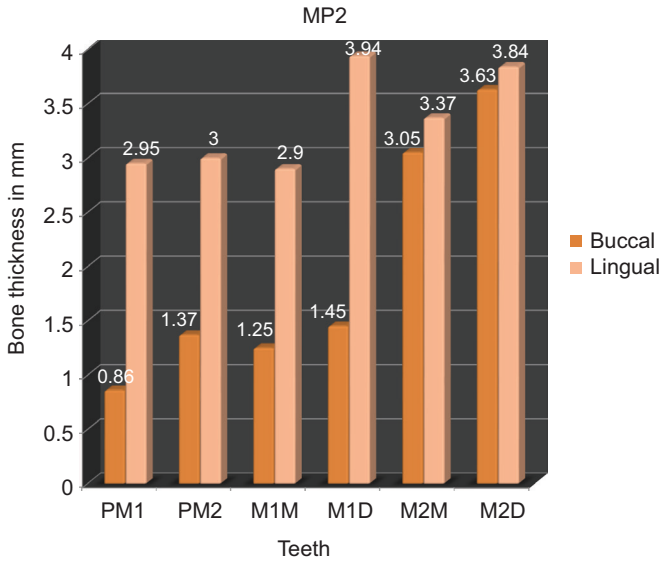
	<1 mm		*1–2 mm*		*>2 mm*	
	Buccal	*Lingual*	*Buccal*	*Lingual*	*Buccal*	*Lingual*
MP1						
PM1	88.23	29.41	11.76	41.17	0	29.41
PM2	88.89	11.11	11.11	50	0	38.89
M1M	64.28	14.28	28.57	35.71	7.14	50
M1D	57.14	0	42.86	35.71	0	64.29
M2M	31.25	6.25	43.75	62.50	25	31.25
M2D	37.50	0	25	31.25	37.50	68.75
MP2						
PM1	64.70	0	29.41	23.52	5.88	76.47
PM2	33.33	5.55	50	5.55	16.67	88.89
M1M	42.86	0	42.86	14.29	14.29	85.71
M1D	28.57	0	50	0	21.43	100
M2M	18.75	0	6.25	6.25	75	93.75
M2D	0	0	25	0	75	100

DISCUSSION

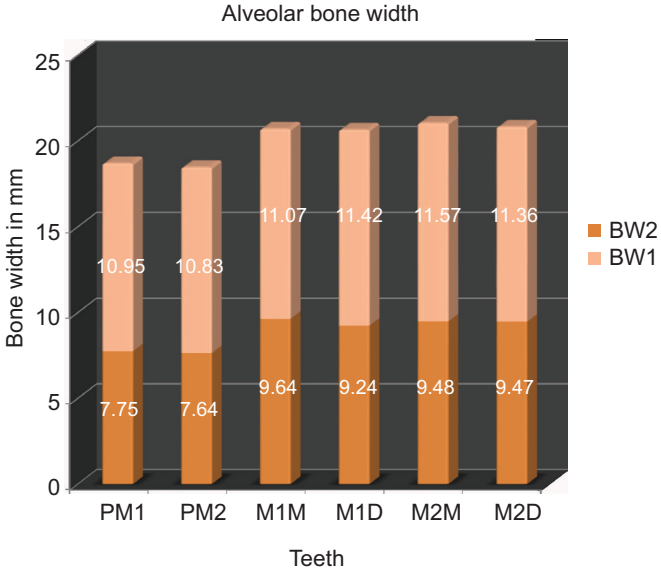
Recently, efforts have been taken to decrease overall treatment time and surgical interventions in implant therapy.



Graph 1: Thickness of buccal and lingual bone walls at MP1



Graph 2: Thickness of buccal and lingual bone wall thickness at MP2



Graph 3: Bone width at BW1 and BW2

Table 7: Alveolar bone width of mandibular posterior teeth

	Minimum (mm)	*Median (mm)*	*Maximum (mm)*	*Mean (mm)*
BW1				
PM1	5.47	7.53	10.75	7.752
PM2	6.66	7.57	9.32	7.641
M1M	7.95	9.54	11.15	9.635
M1D	7.56	9.295	10.92	9.242
M2M	7.71	9.285	11.39	9.476
M2D	6.59	9.53	12.5	9.468
BW2				
PM1	7.96	10.83	13.75	10.948
PM2	7.06	10.91	15.48	10.830
M1M	9.04	11.105	15.11	11.072
M1D	8.86	10.675	15.73	11.416
M2M	8.67	11.295	17.54	11.573
M2D	7.55	11.115	15.39	11.356

BW1: bone width at most coronally detectable alveolar bone, BW2: bone width at the superior border of inferior alveolar canal

Table 8: Dimensions of BW1 and BW2 for all teeth (P < 0.05 significant)

Column1	*BW1 (mean ± SD) (mm)*	*BW2 (mean ± SD) (mm)*	*p*
PM1	7.75 ± 1.16	10.95 ± 1.93	<0.0001
PM2	7.64 ± 0.76	10.83 ± 1.87	<0.0001
M1M	9.64 ± 0.78	11.87 ± 1.07	0.0133
M1D	9.24 ± 0.88	11.42 ± 2.01	0.001
M2M	9.48 ± 1.03	11.57 ± 2.33	0.0026
M2D	9.47 ± 1.5	11.36 + 2.36	0.0112

Alternative to conventional approach, immediate or early implant placement approaches have been proposed.[6] According to the survey of Swiss dental practitioners in 1994, most frequent indications for implant therapy were found to be completely edentulous mandible followed by edentulous posterior mandible.[7,8] Hence, analysis of bone dimensions in posterior mandible for implant placement is important.

Esthetic implant prosthesis, according to Belser et al,[9] was defined as the one that is in harmony with perioral facial structures of the patient. Tomasi et al[3] stated that the thickness of the buccal bone wall is a key determinant of implant treatment success following extraction. The thickness of the buccal bone wall was associated with the degree of defect fill following implant placement.[3] Importance of analysis of bone dimensions before future implant placement is well documented in the literature.

Current trend in implant therapy is shifting from conventional implant therapy to immediate implant therapy. According to Huynh-Ba et al,[10] placement of immediate implant may preserve bone dimensions. Analysis of bone dimensions is a must before immediate implant placement to determine the need of bone augmentation and appropriate treatment planning.

Inadequate amount of remaining bone following implant therapy can cause treatment failure. Following extraction, bony alterations are most commonly seen in the coronal portion of the alveolar ridge. Therefore, measurements of mandibular posterior teeth at MP1 are of utmost importance.[1] In the present study, it was evident that buccal bone dimensions at MP1 for majority of teeth were less than 1 mm. This was observed more in premolars than molars. According to Braut et al,[11] after implant bed preparation, the buccal bone wall should measure at least 2 mm in thickness. This thickness is necessary for maintaining proper soft tissue support and to avoid bone resorption following restoration.[11] Spray et al[12] concluded that bone loss decreased significantly as bone thickness was approximately 2 mm. According to Grunder et al,[13] bone thickness should preferably be 4 mm. If this thickness of bone is not available, then resorption on buccal bone is likely to occur that may cause gingival recession. Analysis showed an increase in thickness of bone from premolars to molars owing to lingual inclination of molars that results in thicker alveolar bone walls.

Vertical distance between BW1 and BW2 was alveolar height H. This H value is of clinical significance, as immediate implants should be placed within this height. Violation of this vertical distance can traumatize inferior alveolar nerve that can lead to implant failure. According to Watanabe et al,[14] prevalence of lingual undercut above inferior alveolar canal was found to be 36 to 39%. Although the implant axis in the mandible should ideally point toward the palatal cusp of the opposing tooth, a lingual undercut increases the risk of lingual perforation and surgical complications. To avoid this anatomical landmark, an implant could be placed off-axially and would have to be restored with an angled abutment.[1,15]

Findings of this study were consistent with those of Braut et al.[1] This study comprised all the patients who were selected for implant placement. Analysis of bone dimensions was done keeping in mind immediate implant therapy if needed in future. Also, this study assesses the prevalence of inadequate bone dimensions at mandibular posterior teeth.

CONCLUSION

Careful preoperative analysis using CBCT is useful in the assessment of thin or missing bone walls and thus determining the need for bone augmentation procedure. Owing to broader alveolar bone and adequate bone thickness, prognosis of implants placed in the molar region is better than that of premolars.

CLNICAL SIGNIFICANCE

To achieve long-lasting and ideal results with the implants, minimum of 2 mm of buccal bone should be preserved.[13] Inadequate bone may result in implant failure. To prevent this, bone augmentation procedures are required. Currently, there is insufficient data regarding preoperative bone dimension analysis of mandibular posterior teeth. As CBCT is the preferred imaging modality for oral and maxillofacial structures, careful preoperative analysis of alveolar bone dimensions may determine the need for bone augmentation. Thus, it will significantly increase the success rate of immediate implant treatment in the mandibular posterior teeth.[1]

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RESEARCH ARTICLE

A Comparative Study of Reliability and Accuracy of Manual and Digital Lateral Cephalometric Tracing

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ABSTRACT

Objective: The aim of this study was to assess the reliability and accuracy of several types of lateral cephalometric attributes commonly used: angular measurements, linear measurements, and ratio when using digital cephalometric software (Nemoceph) with manual tracing method.

Materials and methods: Sample size consisted of 26 lateral cephalometric radiographs. All cephalograms were subjected to both manual and digital cephalometric analysis by the same examiner. Digital analyses were performed on Nemotec digital imaging software. Cephalograms were assessed for a total of 17 cephalometric attributes. The results were assessed using Student's t-test.

Results: Six out of 17 measurements, that is, sella, nasion, B point, ANB, incisor mandibular plane angle, mandibular plane angle, L1-NB, and Jarabak ratio, showed statistically significant difference between the manual and digital methods.

Conclusion: Digital measurements obtained with Nemotec digital imaging software were found to be comparable to the manual method for most of the variables used in clinical practice.

Keywords: Cephalometric measurements, Cephalometric tracing, Digital imaging.

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Conflict of interest: None

INTRODUCTION

The assessment of craniofacial structures forms an integral part of orthodontic diagnosis. In 1931, orthodontics ushered in the age of radiographic cephalometry by the historical work of Broadbent[1] in the United States and Hofrath in Germany, who simultaneously developed techniques for obtaining standardized radiographs of the head. Cephalometric radiography is a valuable tool in diagnosis, prognosis, treatment planning, and evaluation, as well as in studies on the growth and development of the dental and craniofacial complex.[2]

Cephalometric analysis can be performed on cephalograms by a manual approach or a computer-aided approach.[3] Cephalometric analysis performed manually using a tracing sheet is the oldest and the most widely used method. Radiographic film is quite stable and can retain its information for many years, but it is not always a dependable archive medium due to its physical nature. Film deterioration has been the major source of information loss in craniofacial biology.[4]

Computerized cephalometric analysis involves direct digitization of the lateral skull radiograph using a digitizer linked to a computer, and then locating landmarks on the monitor.[5-7] The computer software then completes the cephalometric analysis by automatically measuring distances and angles. Computerized or computer-aided cephalometric analysis eliminates the mechanical errors when drawing lines between landmarks as well as those made when measuring with a protractor.

Computerized cephalometric analysis may use either a manual or an automatic identification of landmarks. Automated systems at present are unable to compete with manual identification in terms of accuracy of landmark position. The landmarks lying on the poorly defined structures are difficult to automatically identify.[8] For digital cephalometry to be a better tool in clinical orthodontics, the cephalometric analysis must be comparable and reliable, as it is on a conventional radiographic film.

The aim of this study was to assess the reliability and accuracy of several types of lateral cephalometric attributes commonly used: angular measurements, linear measurements, and ratio when using digital cephalometric software (Nemoceph, Nemoceph is Software for orthodontics and orthognathic surgery and is manufactured by nemotec (the digital dentistry company)), with manual tracing method.

MATERIALS AND METHODS

Twenty-six pretreatment cephalometric radiographs of adequate diagnostic quality with identifiable craniofacial structures and landmarks were selected for the study. All of these lateral radiographs were obtained from the Radiology Department of MGM Dental College and Hospital and were performed with the patient's head

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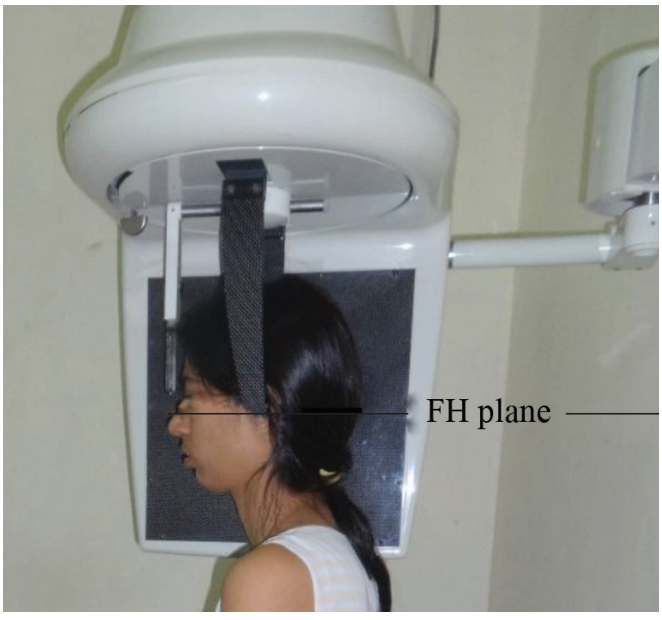

Fig. 1: Orientation of patient in cephalostat

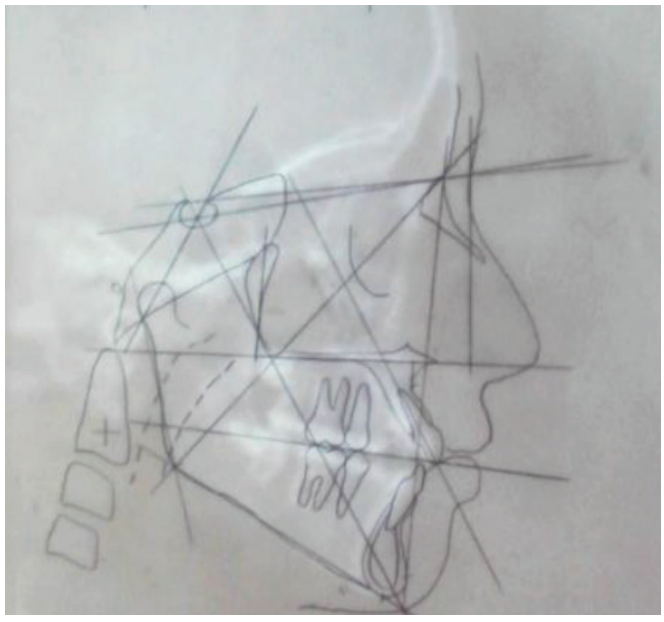

Fig. 2: Manual tracing

immobilized by a cephalostat guided by the Frankfort horizontal plane, parallel to the floor and perpendicular to the mid-sagittal plane (Fig. 1).

Manual Method

Each lateral cephalogram was traced using a 0.3-mm lead pencil on an acetate tracing paper, 0.003″ thick, 8″ wide, and 10″ in length. The tracings were done on a view box with the tracing paper securely positioned over the radiograph. All linear measurements were rounded to nearest 0.5 mm and all angular measurements to nearest 0.5 (Fig. 2).

Digital Method

The digital image of each film was acquired using a digital camera (Sony dscw830) after placing it over the view box. The images were then imported to the Nemotec digital imaging software version 6.0. The images were calibrated using two fixed points common to all cephalograms 10 mm apart. The landmarks were identified manually on the calibrated image and all the measurements were calculated automatically by the software (Fig. 3).

A total of 17 cephalometric measurements were selected for this study in such a way that skeletal, dental, as well as soft tissue parameters could be studied: 10 angular measurements, eight linear measurements, and one ratio.

- The 10 angular measurements selected were sella, nasion, A point (SNA), sella, nasion, B point (SNB), ANB, mandibular plane angle (Go-Gn to SN), basal plane angle, articular angle, U1 to NA, L1 to NB, interincisor angle, and incisor mandibular plane angle (IMPA).
- The eight linear measurements selected were U1 to NA, L1 to NB, anterior cranial base (ACB) length, mandibular length (Go to Pog), L1 to Apog line, Wits analysis, lower lip to S line, and lower lip to E line.
- The ratio used was Jarabak ratio, which is derived as posterior facial height (PFH):
  anterior facial height (AFH).

The measurements obtained from both manual and digital methods were subjected to statistical evaluation.

Statistical Analysis

The measurements derived from manual and digital tracings were compared by using paired samples t-test.

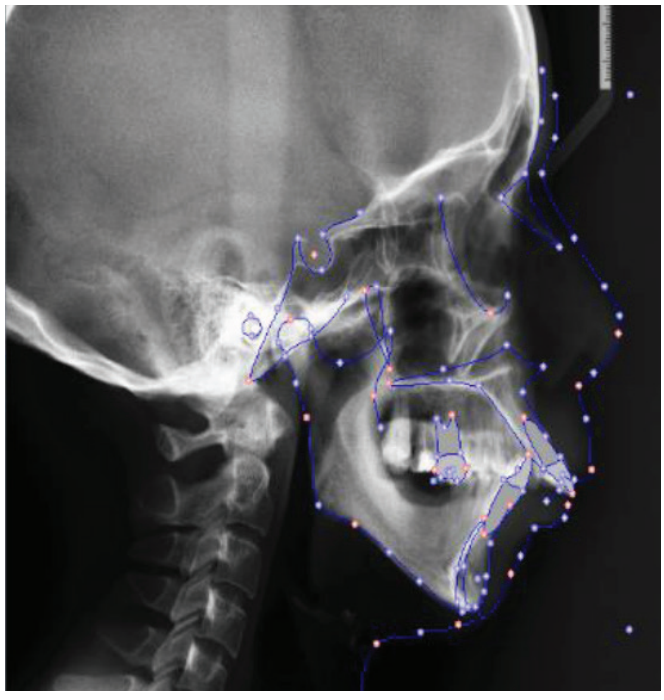

Fig. 3: Digital tracing in Nemoceph

Table 1: Comparison of hard tissue cephalometric measurements obtained by manual and digital methods using Student's t test

S. No.	*Parameter*	*Manual (mean ± SD)*	*Digital (mean ± SD)*	*Difference (mean ± SD)*	*t-value*	*p-value*
Angular measurements						
1	SNA	81.77 ± 4.67	81.84 ± 4.60	–0.07 ± 0.82	–0.457	0.652
2	SNB	78.11 ± 4.51	77.77 ± 4.66	0.34 ± 0.68	2.582	0.016*
3	ANB	3.58 ± 2.91	4.09 ± 2.49	–0.51 ± 0.94	–2.767	0.01*
4	MPA	28.80 ± 6.13	28.17 ± 6.36	0.63 ± 1.47	2.208	0.037*
5	BPA	23.27 ± 4.54	23.21 ± 4.64	0.06 ± 1.57	0.200	0.843
6	IMPA	100.12 ± 9.44	100.77 ± 9.05	–0.65 ± 1.48	–2.270	0.032*
7	U1-NA	34.23 ± 9.78	34.72 ± 9.75	–0.49 ± 1.78	–1.399	0.174
8	L1-NB	29.15 ± 8.34	28.83 ± 8.35	0.32 ± 1.34	1.218	0.235
9	U1-L1	113.31 ± 14.20	112.68 ± 14.08	0.63 ± 1.89	1.687	0.104
Linear measurements						
10	Aa	141.96 ± 4.39	141.45 ± 4.86	0.51 ± 2.61	1.006	0.324
11	Wits	1.04 ± 2.19	1.10 ± 2.42	–0.06 ± 0.45	–0.704	0.488
12	ACBL	63.38 ± 3.52	63.48 ± 4.25	–0.10 ± 1.76	–0.302	0.765
13	MnL	64.96 ± 4.05	64.33 ± 4.21	0.63 ± 2.04	1.586	0.125
14	U1-NA	7.65 ± 3.60	7.80 ± 3.34	–0.15 ± 0.85	–0.905	0.374
15	L1-NB	5.77 ± 2.47	6.15 ± 2.34	–0.38 ± 0.84	–0.385	0.027*
16	L1-Ap	3.35 ± 2.08	3.12 ± 2.07	0.23 ± 0.68	1.728	0.096
17	LI-SI	1.85 ± 2.57	1.75 ± 2.64	0.10 ± 0.45	1.125	0.271
18	L-EI	1.37 ± 2.53	1.22 ± 2.57	0.15 ± 0.47	1.636	0.114
Ratio						
19	JR	66.99 ± 5.19	68.10 ± 5.67	–1.11 ± 1.15	–4.892	< 0.0005**

*p < 0.05: significant, **p < 0.001: highly significant

A p-value of 0.05 was used as the minimal level of statistical significance.

RESULTS

A comparison of angular measurements, linear measurements, and ratio is presented in Table 1.

Angular Measurements

Among the 10 angular measurements that were selected, SNA, basal plane angle, articular angle, U1 to NA, and L1 to NB did not show any statistically significant difference between manual and digital methods. However, SNB, ANB, mandibular plane angle, and IMPA showed statistically significant differences in the two methods ($p > 0.05$).

Linear Measurements

Among the eight linear measurements that were selected in this study, U1 to NA, ACB length, mandibular length, L1 to A-Pog line, Wits analysis, lower lip to S line, and lower lip to E line did not show statistically significant difference between manual and digital methods. However, one linear measurement, L1 to NB, showed statistically significant difference in the two methods ($p > 0.05$).

Ratio

It was observed that Jarabak ratio showed a statistically significant difference between manual and digital methods.

DISCUSSION

Cephalometrics includes measurement, description, and appraisal of dentofacial growth and changes in skull by measuring certain planes, lines, and angles between anthropometric landmarks and points specified by orthodontics.

In this study, six out of 17 parameters assessed showed statistically significant difference in manual and digital methods. These six parameters were four angular measurements (SNB, ANB, IMPA, and mandibular plane angle), one linear measurement (L1-NB), and Jarabak ratio. A majority of these measurements depend on landmarks such as gonion, gnathion, porion, orbitale, point A, and point B, which lie on poorly defined outlines or low contrast areas.

Forsyth and Shaw[8] found that errors in the identification of points, angular, and linear measurements tend to occur more often in digital images than in conventional radiography.

Gregston et al[9] in their study on manual and digital tracings have found difficulties in locating certain landmarks Ar, Gn, Me, Go, Or, Po, Pog, Point A, and lower incisor apex. While different reference planes can be considered for locating point Gn and Go in manual tracings, this is not possible with digital tracings. Baumrind and Frantz[5], and Gravely and Benzies[10] have reported difficulties in tracing incisor position and variation of angular measurements related to incisors between the two tracing methods.

In this study, the significant difference obtained in the two tracing methods for Jarabak ratio can be explained by the difficulty in locating Me and Go in digital tracings. According to Chen et al,[11] the difficulties in locating Me point can be caused by difficulty in locating the landmark on a curved anatomical boundary.

Chen et al[11] stated that the measurement differences of less than 2 units (mm or degree) are generally within one standard deviation of norm values in conventional cephalometric analysis. The parameters with measurement variance of more than 2 units would be considered as a clinically significant difference. In this study, however, no parameter showed a measurement variation of more than 2 units. The largest measurement difference was seen in Jarabak ratio and it was noted to be 1.2 units.

Thus, from the results of this study, it can be inferred that manual and digital cephalometric methods for cephalometric analysis can be used with a reasonably good reliability and accuracy. This is in agreement with the study of Schulze et al[12] wherein they found that although statistically significant differences existed between values obtained from manual and digital tracings, they were clinically insignificant.

Hence, it can be said that digital method can be considered sufficiently reliable for use in orthodontics.

Further research is required to evaluate the reliability of measuring growth changes or treatment effects by superimposition of radiographs by digital method.

CONCLUSION

Digital measurements obtained from digital photographs of analog cephalograms were found to be comparable to manual method, as the differences among the measurements undertaken in this study, though statistically significant, were clinically insignificant. Thus, digital radiography can be reliably used with good accuracy for the measurements of most of the parameters used in routine clinical practice.

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RESEARCH ARTICLE

Frictional Characteristics of the Newer Low-friction Elastomeric Ligatures

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ABSTRACT

Aim: The aim of this *in vitro* study was to investigate the efficiency of the new generation of elastomeric ligatures with innovative designs (Slide™ and AlastiK™ Easy-To-Tie) in reducing frictional resistance (FR) during sliding mechanics as compared with conventional ligatures.

Materials and methods: Sixty ligature samples divided into four groups were used for the study. Group A: QuiK-StiK™ (3M Unitek, Monrovia, CA, USA), Group B: AlastiK™ Easy-To-Tie (3M Unitek, Monrovia, CA, USA), Group C: Slide™ (Leone, Firenze, Italy), and Group D: SS ligatures 0.010″ (Libral Traders, New Delhi, India). Universal Testing Machine, Instron was used for measuring FR at the bracket-wire interface.

Results: There was statistically significant difference in FR among all the four groups of ligatures tested ($p < 0.001$). Slide ligatures produced the least amount of FR followed by SS ligatures, Easy-To-Tie, and QuiK-StiK in the increasing order of the FR values registered.

Conclusion: Slide™ ligatures may represent a valid alternative to passive self-ligating brackets when minimal amount of friction is desired. Angulation introduced into the elastomeric ligatures reduces the friction in comparison to conventional elastomeric ligatures.

Keywords: Angulated elastomeric ligatures, Frictional resistance, Low-friction elastomeric ligatures, Slide ligatures.

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INTRODUCTION

Friction is defined as the resistance to motion when one object moves tangentially against another.[1] When sliding mechanics is used in orthodontics, friction occurs at the bracket-wire interface. Some of the applied force is therefore dissipated as friction and the remainder is transferred to supporting structures of the tooth to mediate tooth movement. This reduces the effectiveness of the mechanics, decreases tooth movement efficiency, and further complicates anchorage control.[2]

In this context, one of the major goals of the orthodontic manufacturing companies is the search for new products that would generate less friction during sliding mechanics. Over the last two decades, major efforts have been made to develop the so-called low-friction brackets, wires, and ligatures.

Schumacher et al[3] found that friction was determined mostly by the type and force of ligation. Ligation with stainless steel (SS) ties can lead to higher forces, as a range of ligating forces may be used by different operators and ligation forces cannot be precisely controlled.[3] Also, incidents of injury to gingival tissues and to the operator have been reported. Although loose SS ligatures produce less friction compared with elastomeric modules,[4-11] and elastomeric ligatures are subject to permanent deformation with time and they also deteriorate in moist environment as a result of slow hydrolysis, the convenience and speed of application elastomeric rings are likely to ensure their continued popularity among clinicians.

To overcome the disadvantages of the conventional ligation techniques, self-ligating brackets were introduced.[12-15] This is a ligature less bracket system with a mechanical device built into the bracket to close off the bracket slot.

Recently, new low-friction ligatures (Slide™, Leone, Firenze, Italy) have been introduced, similar to elastic ligatures, but with an anterior part that is more rigid and similar to the mechanical device of self-ligating brackets. According to the manufacturer, Slide is constructed from a special polyurethane mix approved for medical use. Once the ligature is applied on the bracket, it simulates the labial cover of a passive self-ligating bracket, thus transforming the slot into a tube that allows the archwire to slide freely. Elastomeric ligatures designed with a 45° bend (AlastiK™ Easy-To-Tie; 3M Unitek, Monrovia, CA, USA) were also introduced recently. The manufacturer claims that the unique angle shape reduces the range of movement needed for bracket ligation that makes tie-wing hook-up easier and more efficient.

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The aim of this study was to investigate the efficiency of the new generation of elastomeric ligatures with innovative designs (Slide™ and AlastiK™ Easy-To-Tie) in reducing frictional resistance (FR) during sliding mechanics as compared with conventional ligatures.

MATERIALS AND METHODS

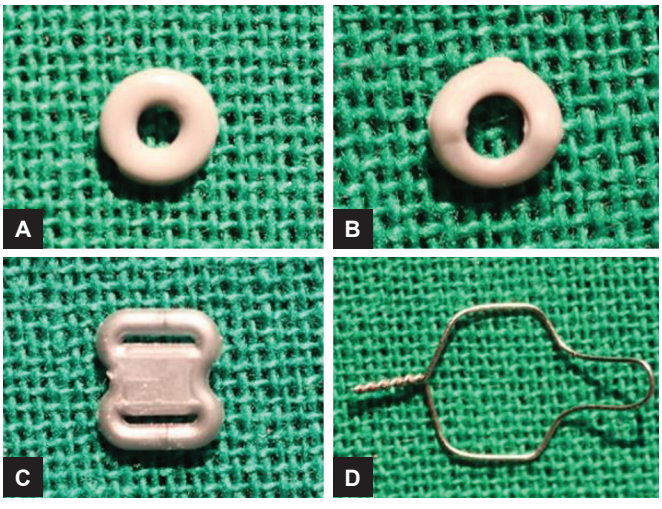
Sixty ligature samples divided into four groups were used for the study (Figs 1A to D). Each group was composed of 15 ligatures as follows:

- Group A (Fig. 1A): QuiK-StiK™ (3M Unitek, Monrovia, CA, USA)
- Group B (Fig. 1B): AlastiK™ Easy-To-Tie (3M Unitek, Monrovia, CA, USA)
- Group C (Fig. 1C): Slide™ (Leone, Firenze, Italy)
- Group D (Fig. 1D): SS ligatures 0.010″ (Libral Traders, New Delhi, India)

Mandibular right central incisor brackets with MBT prescription and 0.022″ slot dimension (Gemini™; 3M Unitek, Monrovia, CA, USA) were used for the study. Straight lengths of 0.019″ × 0.025″ SS wires (Rocky Mountain Orthodontics, Denver, CO, USA) were used for the friction testing. A total of 60 tests were performed. While performing each test new bracket, wire and ligature was used.

Each bracket was mounted on an acrylic block (Fig. 2) using a cyanoacrylate adhesive (Fevi kwik; Pidilite Industries Limited, Mumbai, India). The acrylic blocks were custom made by Matrix Corporation, Govandi, Mumbai. These offered a flat surface onto which brackets could be fixed (Figs 3A to D). Horizontal and vertical laser markings were made on the acrylic blocks to facilitate accurate placement of the brackets.

Universal Testing Machine, Instron (PRAJ Industries, Pune, Maharashtra, India) (Fig. 4) was used for measuring FR at the bracket-wire interface. The Instron consists of two jaws, the upper jaw and the lower jaw. The upper jaw is capable of moving in a vertical direction with the



Figs 1A to D: Ligatures used in the study

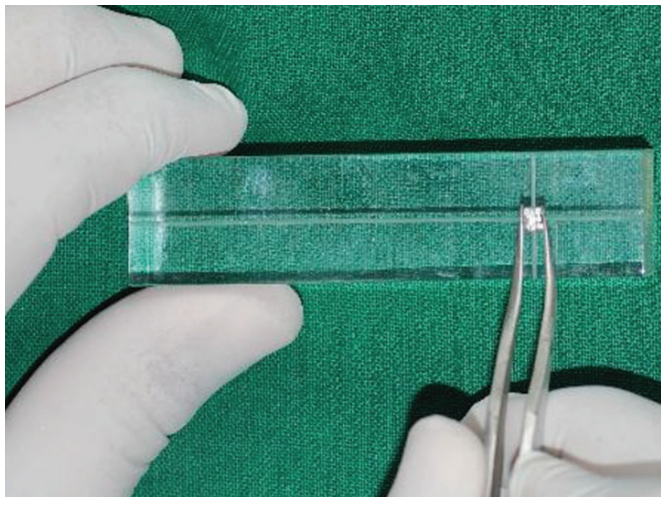
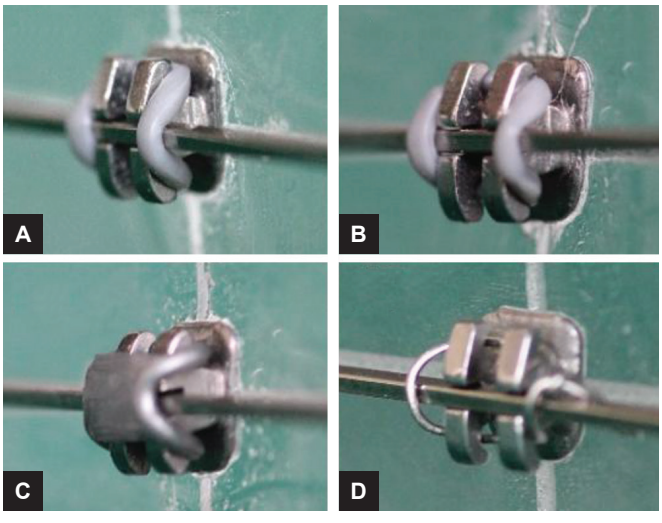


Fig. 2: Fixing of bracket on to acrylic block



Figs 3A to D: Ligatures tied on to the bracket-wire combination: (A) QuiK-StiK™, (B) AlastiK™ Easy-To-Tie, (C) Slide™ and (D) SS ligatures

Fig. 4: Universal testing machine, Instron

desired speed or force depending on the study design. In the present study, speed was the criterion used and force was measured. The lower jaw was rendered to be stationary.

The acrylic blocks were attached to the fixed lower jaw of the Instron machine (Fig. 4) ensuring that the bracket slot is perpendicular to the base of the machine. Straight lengths of wire were fixed to the moving arm of the testing machine and then tied to the bracket slot using ligature. The rate of movement was prefixed at 3 mm per minute, and each test was carried out for 1.5 minutes. The peak FR registered was recorded as the static frictional force**.** A drop of carboxy methyl cellulose based artificial saliva (Wet Mouth; ICPA Health Products Limited) was placed on to the bracket-wire-ligature assembly using a salivary applicator 10 minutes prior to the testing to simulate oral environment (Fig. 5). The force levels needed to move the wire through the bracket slot were registered and transmitted to a computer. Sliding movement was recorded in millimeters (mm), time in minutes and FR in grams.

STATISTICAL ANALYSIS

Data collected were analyzed and presented using descriptive statistics, tables, and charts. Further analysis was done with analysis of variance (ANOVA) followed by Tukey's post hoc test. The level of significance was set at 5%. All p-values less than 0.05 were treated as significant. All statistical computations were performed using Statistical Package for Social Science (SPSS) software Version 20.0.

RESULTS

There was statistically significant difference in FR among all the four groups of ligatures tested ($p < 0.001$) (Table 1). Slide ligatures produced the least amount of FR followed by SS ligatures, Easy-To-Tie, and QuiK-StiK in the increasing order of the FR values registered (Graph 1). On further analysis with Tukey's post hoc test, statistically significant differences were found between all the four groups except between Easy-To-Tie and SS ligatures (Table 2).

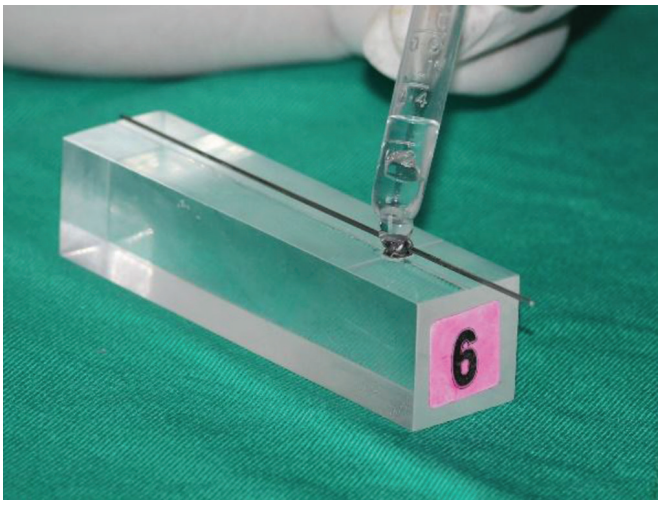
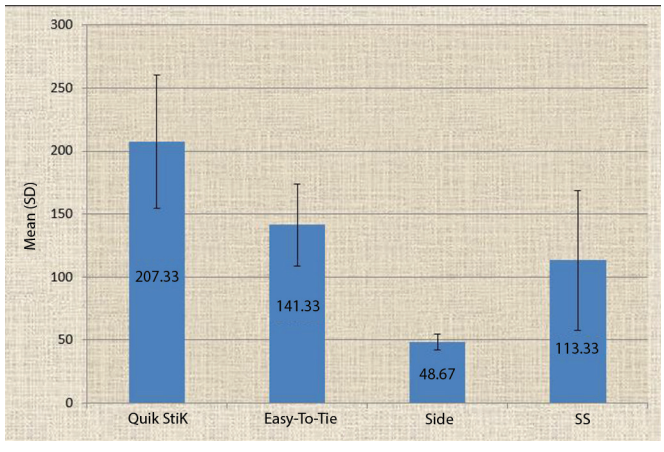


Fig. 5: Application of artificial saliva

Table 1: Comparison of frictional resistance [Mean (SD)] among the groups using one-way ANOVA test

Groups	*No. of samples*	*Frictional resistance Mean (SD)*
QuiK StiK	15	207.33 (53.1)
Easy-to-Tie	15	141.33 (32.5)
Slide	15	48.67 (6.4)
SS	15	113.33 (55.5)
F-value	–	37.096
p-value	–	<0.001**

*p < 0.05: Significant, **p < 0.001: Highly significant



Graph 1: Frictional resistance (gms) registered by the four types of ligatures tested

Table 2: Post hoc analysis (multiple comparisons)

Dependent Variable: FR Tukey HSD

(I) Group		*Mean difference (I-J)*	*Std. error*	*Sig.*	*95% confidence interval*	
					Lower bound	*Upper bound*
QuiK StiK	Easy-to-Tie	66.000*	15.273	0.000	25.56	106.44
	Slide	158.667*	15.273	0.000	118.23	199.11
	SS	94.000*	15.273	0.000	53.56	134.44
Easy-to-Tie	QuiK StiK	–66.000*	15.273	0.000	–106.44	–25.56
	Slide	92.667*	15.273	0.000	52.23	133.11
	SS	28.000	15.273	0.269	–12.44	68.44
Slide	QuiK StiK	–158.667*	15.273	0.000	–199.11	–118.23
	Easy-to-Tie	–92.667*	15.273	0.000	–133.11	–52.23
	SS	–64.667*	15.273	0.000	–105.11	–24.23
SS	QuiK StiK	–94.000*	15.273	0.000	–134.44	–53.56
	Easy-to-Tie	–28.000	15.273	0.269	–68.44	12.44
	Slide	64.667*	15.273	0.000	24.23	105.11

*The mean difference is significant at the 0.05 level

DISCUSSION

When sliding mechanics is used, friction occurs at the bracket-wire interface. Some of the applied force is therefore dissipated as friction and the remainder is transferred to supporting structures of the tooth to mediate tooth movement. Therefore, maximum biological tissue response occurs only when the applied force is of sufficient magnitude to adequately overcome friction and yet be within the optimal range of force necessary for effecting movement of the tooth.

Thus, the clinical advantage of reduced resistance to sliding should translate to reduction in the amount of time to move teeth.[1] Studies involving comparative assessment of frictional force values generated while using new ligatures elicit important data that link didactic research with clinical applicability within the limits of *in vitro* models. In the present study, carboxy methyl cellulose based artificial saliva was used to simulate oral conditions. Leal et al[16] suggested that mucin and carboxy methyl cellulose based artificial saliva provides a reliable alternative to human natural saliva.

The variations in the experimental methods used in different studies in the literature make it difficult to compare our results with that of other studies of this type. However, some similarities in the findings were observed.

Slide™ ligatures showed levels of friction that were significantly lower than all the other three groups tested. This was in agreement with the findings of Baccetti and Franchi,[17] Tecco et al,[18] and Sivaraj.[19] One of the most favorable features of the Slide™ ligatures is the possibility of turning any type of existing conventional bracket system into a ''low-friction'' bracket system. Furthermore, these innovative ligatures can be applied on specific groups of teeth wherein lower levels of friction are desired.

Pairwise comparison revealed that the 45° angulated AlastiK™ Easy-To-Tie produced lower FR values than conventional elastomeric ligatures (QuiK-StiK™). SS ligatures generated lower FR values than AlastiK™ Easy-To-Tie ligatures. However, the difference was statistically not significant, implying that both SS ligatures and AlastiK™ Easy-To-Tie were equally efficient in reducing FR when compared with conventional elastomeric ligatures. These results concur with the findings of Arun and Vaz.[20]

CONCLUSION

- Among the different types of elastomeric ligatures compared in this study, Slide™ ligatures produced the least friction, followed by 45° angulated AlastiK™ Easy-To-Tie elastomers.
- Due to the special design, Slide™ ligatures may represent a valid alternative to passive self-ligating brackets when minimal amount of friction is desired.
- Angulation introduced into the elastomeric ligatures reduces the friction in comparison to conventional elastomeric ligatures.

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RESEARCH ARTICLE

Assessment of Knowledge, Perception, Attitude, and Practices of Expectant and Lactating Mothers regarding their own as well as their Infants' Oral Health in Qassim Province, Kingdom of Saudi Arabia

Nabila Ahmed Sedky

ABSTRACT

Objectives: Assessing knowledge, perception, attitude, and practices of pregnant/lactating mothers concerning their own and their infants' oral health in relation to their oral health status and educational level.

Materials and methods: Anonymous self-administered questionnaire, 317 completed it, response rate = 90.57%. It constituted sections for demography, evaluating oral health knowledge during pregnancy/postpartum, saliva-sharing behavior of mother with baby, infant-feeding practices, and perception of oral health knowledge and attitudes. Oral health condition was measured using decayed, missing, and filling, papillary, marginal, and attached gingiva, and simplified oral hygiene indices. Four scores were constructed from participants' responses to interpret results.

Results: Fair oral hygiene, moderate gingivitis, and caries index was the oral health status, with negative correlation with educational level. About 66.88% had poor perception and practices toward their oral health during pregnancy, with significant difference and negative correlation with oral health status. Significant difference (P<0.001) & positive correlation was detected regarding knowledge about causes of oral/dental problems and oral health attitude in relation to level of education with 58.68% poor knowledge and negative attitude. Above three quarters had poor knowledge and practices and negative attitude for their infants' oral health, with significant result and positive correlation with educational level. Poor perception (54.26%) was recorded regarding causes of oral/dental diseases, methods of tooth cleaning, and types and benefits of using toothpaste in relation to oral health status with a significant difference and negative correlation.

Conclusion: Data revealed that expectant and lactating mothers had poor knowledge, perception and practices, and negative attitude toward their oral health during pregnancy and postpartum as well as their children's oral health.

Keywords: Attitude, DMFT index, Expectant and lactating mothers, Knowledge, Perception, Practices, OHI-S index, Oral health, PMA index.

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INTRODUCTION

Oral health care is an essential feature of general health care that has an influence on the quality of life and health consequences in infants and children.[1] In children, it is an essential aspect in the prevention of dental caries, which is the most prevalent childhood dental problem.[2]

Mothers are an essential source of early learning in children concerning good hygiene and healthy nutritional procedures.[1] So, pediatric oral health care should commence perfectly with prenatal oral health advising for parents, particularly mothers who commonly spend extra time with their children. The first oral examination is recommended at the time of the eruption of the first tooth and not delayed than 12 months of age.[3] There is growing proof signifying that to be successful in preventing dental disease, preventive interferences must commence within the first year of life.[4,5]

These interferences foster healthy dietary habits, enable proper monitoring of the developing dentition and occlusion, prevent dento-facial accidental injuries, and determine oral habits that may be harmful to occlusal development and general health of the oral tissues.[3,6] Thus, the level of knowledge of pediatric oral health care of mothers will pinpoint their competence to impose and improve such behaviors in their children.[7]

The perinatal stage is explained as the period around the time of birth, starting with the accomplishment of the 20th throughout 28th week of pregnancy and ending 1 to 4 weeks following birth.[8] Perinatal oral health plays a vital role in the general health and prosperity of pregnant women.[9] Many women do not request dental care during their pregnancy, and those that do regularly encounter reluctance of dentists to provide care.[10-13] Many expectant mothers are unacquainted of the consequences of poor oral health for themselves, their pregnancy, and/or their unborn child.[13-15]

The extreme inflammatory reaction of the gums to bacterial plaque identified as pregnancy gingivitis has been referred to the increased secretion of gestational hormones particularly estrogen and progesterone during pregnancy.[16,17] Bacterial plaque formation can be prohibited by consistent tooth brushing, the usage of dentifrices as well as dental education. Moreover, appropriate diet and healthy lifestyle play an imperative role in the overall wealth of the mother to be.[17] The necessity to eat a balanced diet with plenty of fruits cannot be stressed enough. Unfortunately, the pregnant condition may predispose to unhealthy behaviors such as licking sweets to reduce nausea that will afford an appropriate substrate for cariogenic bacteria and may predispose to increased tooth decay in some individuals.[18]

In addition, mothers with poor oral health and high levels of cariogenic oral bacteria are at superior risk for infecting their children with the bacteria and intensifying their children's caries risk at an early age.[19] Dental caries in infants is a disease that commonly is preventable. Defining those mothers at highest risk for transmitting cariogenic bacteria to their children enhances chances for preventive interference.[20]

The essential goal of perinatal oral health care, concerning the transmission of caries, is to reduce the numbers of cariogenic bacteria in pregnant women's mouth so that mutans streptococci (MS) colonization of the infant can be postponed as long as feasible.[21] Appropriate delivery of educational information and preventive therapies to these parents can diminish the incidence of early childhood caries (ECC), restrain the necessity for dental rehabilitation, and enhance the oral health of their children.[22-24] Physicians, nurses, and other health care professionals are most probably to see expectant or new mothers and their infants than are dentists. Consequently, it is fundamental that these providers be perceptive of the infectious etiology and concomitant risk factors of dental caries and ECC, make proper decisions with regard to appropriate and efficient interferences for pregnant women, and enable the foundation of a dental home.[25-27]

However, no qualitative researches have investigated the oral health experiences of pregnant and parenting adolescent women in the Saudi society, that is, the purpose of the present study that used to assess the knowledge, perception, attitude, and practices concerning pregnant and lactating women's oral health and their infants' oral health receiving pre- and postnatal care at Buraidah Maternity and Pediatric hospital in relation to their oral health status and level of education. The results obtained would serve as baseline data for planning an oral health education program aimed at improving the oral health of expectant and lactating mothers. Specifically, it would identify areas of deficiency in the women's knowledge, perception, attitude, and practices, and this would be beneficial in creating the content of the oral health education messages.

MATERIAL AND METHODS

A cross-sectional study was conducted at Buraidah Maternity and Pediatric hospital, a Governmental Hospital in Qassim Province, KSA, which is frequented by pregnant women and lactating mothers from all regions of the central region, between January and March 2015, after obtaining a prior permission from the concerned authorities as well as the approval of the Dental Ethical Committee for the study protocol. The study sample was randomly selected from pregnant women and mothers of children up to 1 year of age. The pregnant females were selected from the antenatal department and the mothers were chosen when they use to come for immunization or pediatric visit at the hospital. After being disclosed the nature of the study, a total of 350 ladies signed the approval to participate in the study through an informed consent form and participated in the study by completing an anonymous self-administered structured questionnaire. Subjects who were not willing to contribute in the study and mothers of children with congenital anomalies and twins were excluded. Three hundred seventeen participants properly completed the questionnaires, while 33 questionnaires had several uncompleted sections and were thus rejected with a response rate = 90.57%.

The questionnaire was translated into Arabic language and filled by the investigator to prevent bias, then it was pre-tested on randomly selected 35 expectant and lactating mothers (10%) to allow for refinement of the questions in order to facilitate answering and to ensure its comprehension, practicability, validity, interpretation of responses, and reliability (Cronbach's alpha $\alpha = 0.875$).

The questionnaire used a simple tick-box format, with sections for demographic items (such as age, level of education, occupation, number of children, and current situation). There were 14 questions in the 2nd section evaluating the oral health knowledge of the respondents during pregnancy and three questions postpartum. The third section constituted four questions with regard to saliva-sharing behavior of the mother with the baby, the oral cleansing methods for the infant and the mothers' knowledge about the age of eruption of first tooth. The fourth section enquired about infant-feeding practices (eight questions). The last section asked about the perception of oral health knowledge and attitudes of the contributors.

Finally, the oral health condition of the participants was measured using decayed, missing, and filling (DMFT) index for caries measurement,[28] as well as papillary, marginal, and attached gingiva (PMA) index for periodontal status,[29] and lastly the simplified oral hygiene (OHI-S) index for oral hygiene status.[30]

In order to simply interpret the results, four scores were constructed from the participants' responses. The first one was "perception & practices of oral health during pregnancy"; this score was created by counting the total number of the correct answers given by the contributors. Consequently, the perception and practices score was in an interval scale and ranged from 0 to 6, the maximum attainable score was 5, with a higher perception and practices score signifying better dental knowledge. The perception and practices scores were regrouped into two categories: those with good perception and practices and those with poor perception and practices. Thus, a score of 3 and above was graded as good perception, while 2 and below was graded as poor perception. The second score was "knowledge about causes of oral & dental problems and attitude toward oral health"; this score was constructed similarly as the previous score. The knowledge and attitude score ranged from 0 to 9, with a mean score of 4.5. Based on the mean score, the knowledge and attitude scores were aggregated into two categories: those with good knowledge and positive attitude (score of 6 and above) in addition to those with poor knowledge and negative attitude (score of 5 and below). Similarly, the 3rd and 4th scores were calculated where the third one was related to "knowledge, attitude & practices about infants' oral health" with a range from 0 to 12, the maximum achievable score was 9. Regrouping of the knowledge, attitude, and practices scores resulted in two categories: 6 and above was graded as high knowledge, positive attitude, and practices, while 5 and below was graded as low knowledge, negative attitude, and practices. The fourth score was "perceived causes of oral & dental diseases, methods of tooth cleaning, types and benefits of using toothpaste" that ranged from 0 to 18, with a maximum of 16. So, 9 and above was graded as high perception, and 8 and below was graded as low perception.

In addition, for the point of analysis, the level of education was classified as low (illiterate), middle (middle and secondary education), and high (university and graduated). Moreover, caries measurement (DMFT Score) was also categorized as low (DMT 1–7), moderate (DMT 8–15), and high (DMT 16–32). Whereas the OHI-S was scored as followed[30] 0 = excellent oral hygiene, 0.1-1.2 = good oral hygiene, 1.3-3.0 = fair oral hygiene, and 3.1-6.0 = poor oral hygiene. Finally, the modified PMA Index was scored as[29] 0 = No gingivitis, 0.1-1 = Mild gingivitis, 1.1-2 = Moderate gingivitis, and 2.1-3 = Severe gingivitis.

Statistical Analysis

Statistical analysis was conducted using the SPSS program (SPSS 19.0 for windows; SPSS Inc., Chicago, USA). All statistical analyses were carried out at a significance level less than 0.05 and 0.01. The data were analyzed for frequency distributions. Data were subjected to descriptive statistics such as frequencies, percentages, and cross-tabulation. The Chi-square test for association between studied variables and oral health status as well as level of education was performed, and finally, Pearson's correlation coefficient was used to investigate associations between variables.

RESULTS

Three hundred seventeen contributors have accurately fulfilled the questionnaires. The mean age of respondents was 29.77 years, SD ± 6.13 years; range 17 to 41 years. Regarding the level of education of the participants, 19.24% were illiterate, 41.96% were middle and secondary school educated, and 38.80% were university educated and graduated. Moreover, 69.40% were housewives, 25.87% employees, 1.89% professionals, and 2.84% were students.

Table 1 reveals the current status and oral health situation of the participants, and the majority of the contributors (62.78%) had one to three children. Concerning the current situation of the studied subjects, 73.82% were pregnant and 26.18% were lactating. Among the pregnant females, 65.38% were in the 3rd semester, 20.51% in the 2nd semester, and only 14.10% in the 1st semester. With regard to the oral health status, the mean value of OHI-S index was found to be 1.35; PMA index was 1.39 indicating fair oral hygiene and moderate gingivitis respectively, while mean DMFT was 10.37 representing moderate caries index. Moreover, caries prevalence among the studied group was found to be 100% with the decayed component contributed maximum (90.85%) followed by

Table 1: Current situation and oral health status of the participants

Variable		*Frequency*	*Percent*
Number of children (N = 317)	No children	6	1.89
	One – Three	118	62.78
	More than three	112	35.33
Current situation (N = 317)	Lactating	83	26.18
	Pregnant	234	73.82
Trimester (N = 234)	1st trimester	33	14.10
	2nd trimester	48	20.51
	3rd trimester	153	65.38
		Mean	
Oral health status (N = 317)	DMFT Index	10.37	
	OHI-S Index	1.35	
	PMA Index	1.39	

Table 2: Dental and oral health status of the participating women in relation to their level of education

		DMFT Index				
Level of Education		*Low*	*Moderate*	*High*	*Total*	χ^2 (p)
Low	Count	12	46	3	61	27.741* (0.000)
	% within level of education	19.67	75.41	4.92	19.24	
Middle	Count	52	55	26	133	
	% within level of education	39.10	41.35	19.55	41.96	
High	Count	52	63	8	123	
	% within level of education	42.28	51.22	6.50	38.80	
Total	Count	116	164	37	317	
	% within level of education	36.59	51.74	11.67	100	

		OHI-S Index					
Level of Education		*Excellent oral hygiene*	*Good oral hygiene*	*Fair oral hygiene*	*Poor oral hygiene*	*Total*	χ^2 (p)
Low	Count	0	23	27	11	61	67.451* (0.000)
	% within level of education	0.00	37.70	44.26	18.03	19.24	
Middle	Count	9	51	70	3	133	
	% within level of education	6.77	38.35	52.63	2.26	41.96	
High	Count	17	78	28	0	123	
	% within level of education	13.82	63.41	22.76	0.00	38.80	
Total	Count	26	152	125	14	317	
	% within level of education	8.20	47.95	39.43	4.42	100	

		PMA Index					
Level of Education		*No gingivitis*	*Mild gingivitis*	*Moderate gingivitis*	*Severe gingivitis*	*Total*	χ^2 (p)
Low	Count	3	8	24	26	61	59.522* (0.000)
	% within level of education	4.92	13.11	39.34	42.62	19.24	
Middle	Count	15	39	23	56	133	
	% within level of education	11.28	29.32	17.29	42.11	41.96	
High	Count	18	58	38	9	123	
	% within level of education	14.63	47.15	30.89	7.32	38.80	
Total	Count	36	105	85	91	317	
	% within level of education	11.36	33.12	26.81	28.71	100	

*$p < 0.001$

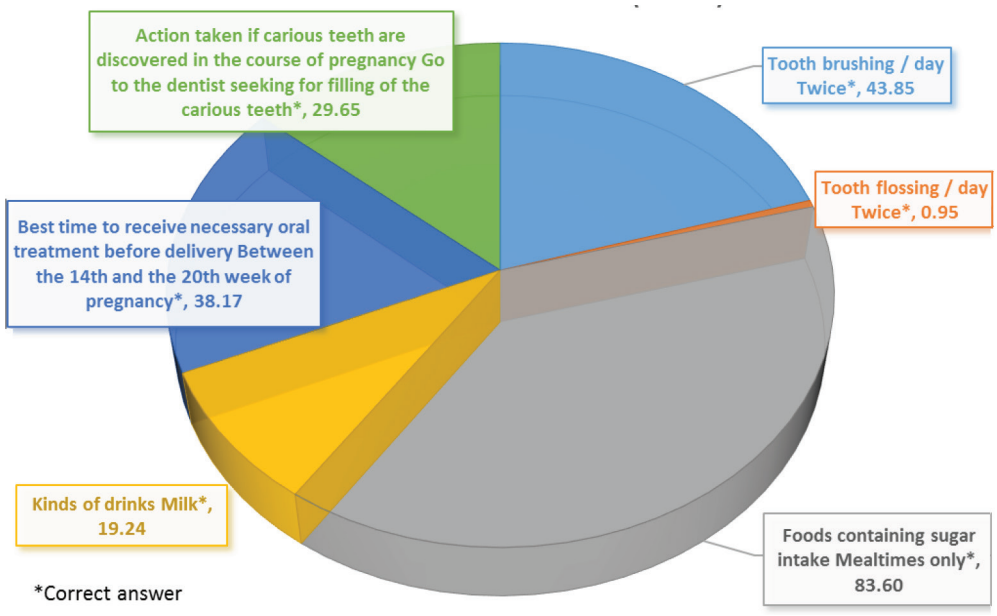
filled component (73.50%) and lastly missing component (72.56%).

Data in Table 2 represent the relation between the level of education of the contributing mothers and their dental and oral health status. A statistical significant difference was found between the level of education and the participants' dental and oral health in the form of DMFT index ($\chi^2 = 27.741$*, $p = 0.000$), OHI-S index ($\chi^2 = 67.451$*, $p = 0.000$), and PMA index ($\chi^2 = 59.522$*, $p = 0.000$) with the higher the level of education the better the condition either dental or oral.

Pie Chart 1 displays the mothers' perception and practices of oral health during pregnancy. It was found that only 0.95% of the participants practicing tooth flossing/day (twice) correctly, and 43.85% replied that they performing tooth brushing twice/day. Moreover, merely 19.24% perceived that milk is the kind of drinks they have to receive during pregnancy. Regarding the best time to receive necessary oral treatment before delivery, just 38.17% of the contributors answered correctly and for the action that has to be taken if carious teeth are discovered in the course of pregnancy, only 29.65% registered that they have to go to the dentist for filling of the carious teeth. Finally, the majority of the studied subjects (83.60%) perceived that foods containing sugar intake should be mealtimes only.

Table 3 demonstrates the relation between the respondents' oral health perception and practices during pregnancy and their oral health status. It was found that about two-thirds (66.88%) of the contributing mothers had poor perception and practices toward their oral health during pregnancy, while one-third of the participants (33.12%) recorded good perception and practices. A statistically significant difference was detected between oral health perception and practices in relation to dental and oral health status in the form of DMFT index ($\chi^2 = 8.856$*, $p = 0.012$), OHI-S index ($\chi^2 = 11.784$**, $p = 0.008$) as well as PMA index ($\chi^2 = 13.927$**, $p = 0.003$). Considering caries measurement, high DMFT score constituted the highest percentage for the participating women whether

Pie Chart 1: Mothers' perception and practices of oral health during pregnancy (N=317)



they disclosed poor perception and practices (52.83%) or good perception and practices (40.95%) for their oral health during pregnancy. Furthermore, related to oral hygiene status of the contributors, "good" as well as "fair" oral hygiene categories were the most prominent conditions of the sharing women either with poor (42.92% and 45.28% respectively) or good (58.10% and 27.62% respectively) perception and practices. With regard to the PMA index, the highest percentage of the involved women had mild gingivitis either with poor perception and practices (33.02%) or with good perception and practices (33.33%).

Table 3: Scoring of mothers' perception & practices of oral health during pregnancy in relation to their oral health status

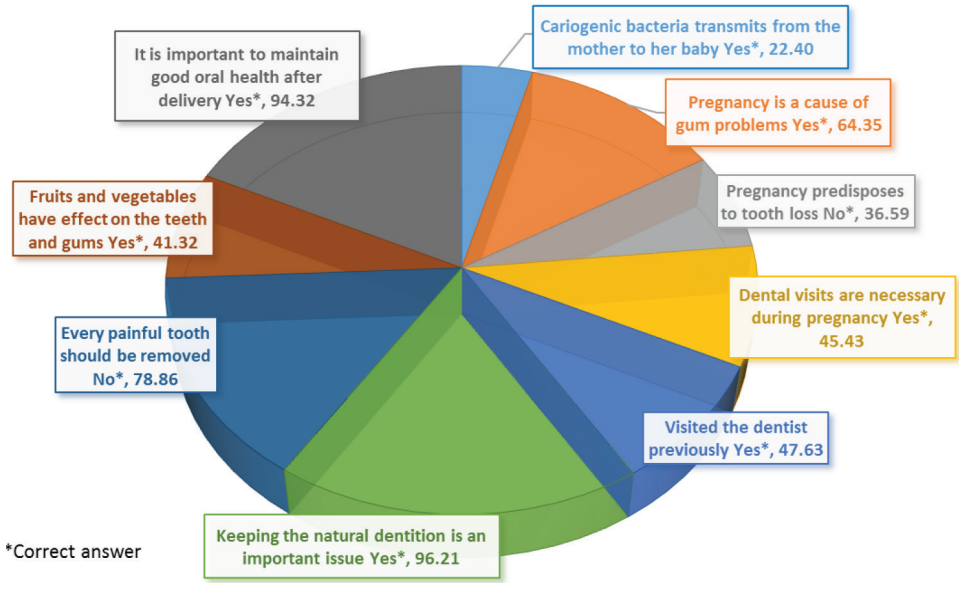
Scoring of perception & practices of oral health during pregnancy		*DMFT Index*				
		Low	*Moderate*	*High*	*Total*	χ^2 (p)
Poor perception and practices	Count	23	77	112	212	8.856* (0.012)
	% within Scoring	10.85	36.32	52.83	66.88	
Good perception and practices	Count	24	38	43	105	
	% within Scoring	22.86	36.19	40.95	33.12	
Total	Count	47	115	155	317	
	% within Scoring	14.83	36.28	48.90	100	

Scoring of perception & practices of oral health during pregnancy		*OHI-S Index*					
		Excellent oral hygiene	*Good oral hygiene*	*Fair oral hygiene*	*Poor oral hygiene*	*Total*	χ^2 (p)
Poor perception & practices	Count	14	91	96	11	212	11.784** (0.008)
	% within Scoring	6.60	42.92	45.28	5.19	66.88	
Good perception & practices	Count	12	61	29	3	105	
	% within Scoring	11.43	58.10	27.62	2.86	33.12	
Total	Count	26	152	125	14	317	
	% within Scoring	8.20	47.95	39.43	4.42	100	

Scoring of perception & practices of oral health during pregnancy		*PMA Index*					
		No gingivitis	*Mild gingivitis*	*Moderate gingivitis*	*Severe gingivitis*	*Total*	χ^2 (p)
Poor perception & practices	Count	15	70	65	62	212	13.927** (0.003)
	% within Scoring	7.08	33.02	30.66	29.25	66.88	
Good perception & practices	Count	21	35	20	29	105	
	% within Scoring	20.00	33.33	19.05	27.62	33.12	
Total	Count	36	105	85	91	317	
	% within Scoring	11.36	33.12	26.81	28.71	100	

*p < 0.05; **p < 0.001

Pie Chart 2: Knowledge of participants about causes of oral & dental problems as well as their attitude toward oral health



Pie Chart 2 depicts the knowledge of the participants about causes of oral and dental problems as well as their attitude toward oral health. The results revealed that only 22.40% of women knew that cariogenic bacteria transmit from the mother to her baby through intimate contact and just 36.59% recognized that pregnancy does not predispose to tooth loss. Moreover, the majority of the sharing women had positive attitude toward oral health in the form of keeping the natural dentition is an important issue (96.21%), the importance of maintaining good oral health after delivery (94.32%) and that it is not necessary to remove every painful tooth (78.86%). On the contrary, negative attitude was represented through dental visits, as only 45.43% of mothers stated that dental visits are necessary during pregnancy and 47.63% reported that they visited the dentist previously.

Considering the relationship between the respondents' knowledge about causes of oral and dental problems as well as their attitude toward oral health in relation to their level of education, 58.68% were found to have poor knowledge and negative attitude, while 41.32% of mothers held good knowledge and positive attitude with a statistically significant difference between groups ($\chi^2 = 20.039$*, $p = 0.000$). Referring to the results, it was found that 40.32% of sharing mothers had poor knowledge and negative attitude, though they had high level of education, Table 4.

Enquiry about knowledge, attitude, and practices of participant mothers about their infants' oral health, Table 5 revealed that the majority of women (71.29%) knew that their babies' first teeth erupted at age of 6 months. On the contrary, merely 5.99% stated that they cleaned the dropped pacifier or toy by washing with water, and only 32.18% said that they did not share the spoons or other utensils with the baby. Moreover, just 38.30% of the mothers recognized that the infants' gum pads should be cleaned with wet gauze. Interpreting the infant feeding practices, the majority (82.33%) registered that they did not use sweetened pacifier, while more than half of the participants (58.99%) did not practice sugar contains milk/fluid, and only about one-third of mothers (33.75%) did not apply nocturnal bottle feeding. In addition, asking about dental visits, just 12.30% of mothers recorded that the first visit of the child to dentist

Table 4: Scoring of knowledge of mothers' about causes of oral and dental problems as well as their attitude toward oral health in relation to their level of education

Scoring of knowledge about causes of oral and dental problems as well as attitude of mothers' toward oral health		*Level of education*				
		Low	*Middle*	*High*	*Total*	χ^2 (p)
Poor knowledge and negative attitude	Count	49	62	75	186	20.039* (0.000)
	% within Scoring	26.34	33.33	40.32	58.68	
Good knowledge and positive attitude	Count	12	71	48	131	
	% within Scoring	9.16	54.20	36.64	41.32	
Total	Count	61	133	123	317	
	% within Scoring	19.24	41.96	38.80	100	

*$p < 0.001$

Table 5: Knowledge, attitude, and practices of participants about their infants' oral health (N = 317)

Variable			*Frequency*	*Percent*
The age of eruption of first tooth		At 6 months*	226	71.29
Saliva-sharing behavior of mother with baby	Spoons or other Utensils	Not shared with the baby*	102	32.18
	Dropped Pacifier or Toy	Cleaning by washing with water*	19	5.99
Methods of cleaning gum pads for infants		With wet gauze*	123	38.80
Infant feeding practices	Use of sweetened pacifier	No*	261	82.33
	Sugar contains milk/fluid	No*	187	58.99
	Nocturnal bottle feeding	No*	107	33.75
Dental visits	Child's first visit to the dentist	When the first (milk) tooth erupts*	39	12.30
	Reason for child's visit to dentist	For routine check-up twice a year*	74	23.34
Oral Cleansing Methods for the child	When should you start cleaning your child's teeth?	When one (milk) tooth erupts*	57	17.98
	What should be used in cleaning a baby's teeth?	Small soft round nylon wet brush without toothpaste*	54	17.03
	When should children start brushing by themselves?	8 years*	35	11.10

*The correct answer

should be when the first (milk) tooth erupted, and 23.34% stated that the reason for child's visit to dentist is for routine check-up and it should be twice a year, indicating poor knowledge and negative attitude toward their infants' oral health. With regard to oral cleansing methods of the child, only 17.98% registered that they started cleaning their child's teeth when one (milk) tooth erupted and 17.03% cleaned the bay's tooth with small soft round nylon wet brush without toothpaste, again signaling poor knowledge and practices, while 11.10% recorded that children should start brushing by themselves at 8 years old.

The relationship between scoring of knowledge, attitude, and practices of mothers' about their infants' oral health and their level of education is demonstrated in Table 6. It was found that more than three quarters of the participants (79.18%) possessed poor knowledge and practices as well as negative attitude toward their infants' oral health, while merely 20.82% of them had good knowledge and practices as well as positive attitude, with a statistically significant results between groups ($\chi^2 = 31.959^*$, $p = 0.000$). Concerning level of education, it was detected that less than one quarter (24.30%) of the participants with low education level had poor knowledge and practices in addition to negative attitude meaning that though the participating women had high and middle levels of education they owned poor knowledge and practices and negative attitude toward their infants' oral health.

Perceived causes of oral and dental diseases as well as methods of tooth-cleaning types and benefits of using toothpaste are presented in Table 7. Results revealed that just 5.99% of women perceived that dental caries is caused as a result of presence of bacterial plaque and also 28.08% registered that plaque causes gum diseases. On the contrary, dental floss and other interdental cleaning aids was perceived by merely 13.56% of the sharing women as one of the appropriate methods used daily for tooth cleaning to prevent dental caries. With regard to the types of toothpastes usually used, a low perception was recorded among the study group concerning the anti-plaque (7.89%), the anti-calculus (11.04%), the whitening (14.83%) and the desensitizing (37.54%) types of toothpastes, while the situation for fluoridated toothpastes was not much better as only 50.79% of the contributors distinguished this type of toothpastes. Moreover, the involved women realized the benefits of using toothpaste, where 81.70% registered that they prevented dental decay, 76.34% recorded that they make the mouth clean and fresh, and 50.79% disclosed that they prevent gum diseases.

Table 6: Scoring of knowledge, attitude, and practices of participants about their infants' oral health in relation to their level of education

Scoring of knowledge, attitude, and practices of participants about their infants' oral health		*Level of education*				χ^2 (p)
		Low	*Middle*	*High*	*Total*	
Poor knowledge, negative attitude, and practices	Count	61	110	80	251	31.959* (0.000)
	% within Scoring	24.30	43.82	31.87	79.18	
Good knowledge, positive attitude, and practices	Count	0	23	43	66	
	% within Scoring	0.00	34.85	65.15	20.82	
Total	Count	61	133	123	317	
	% within Scoring	19.24	41.96	38.80	100	

*$p < 0.001$

Table 7: Perceived causes of oral and dental diseases as well as methods of tooth cleaning, types, and benefits of using toothpaste

Variable		*Frequency*	*Percent*
Causes of dental caries (Multiple Response)	Sugar/sweet foods*	282	88.96
	Poor oral hygiene*	251	79.18
	Bacterial Plaque*	19	5.99
Causes of gum diseases (Multiple Response)	Bacterial Plaque*	89	28.08
	Calculus/tartar*	146	46.06
	Poor oral hygiene*	181	57.10
The appropriate methods used daily for tooth cleaning to prevent dental diseases (Multiple Response)	Miswak*	135	42.59
	Toothbrush and toothpaste*	276	87.07
	Dental floss and other interdental cleaning aids*	43	13.56
	Mouthrinses*	90	28.39
Types of toothpastes usually used (Multiple Response)	Fluoridated*	161	50.79
	Desensitizing*	119	37.54
	Anti-calculus*	35	11.04
	Anti-plaque*	25	7.89
	Whitening*	47	14.83
Benefits of using toothpaste (Multiple Response)	Makes the mouth clean and fresh*	242	76.34
	Prevents Dental decay*	259	81.70
	Prevents gum disease*	161	50.79

*The correct answer

Table 8 summarizes scoring of perceived causes of oral and dental diseases, methods of tooth cleaning, and types and benefits of using toothpaste in relation to respondents' oral health status. Results revealed that 54.26% of the mothers had poor perception, while good perception constituted 45.74% of the participants with a statistically significant difference between groups regarding mothers' oral health status measured through

Table 8: Scoring of perceived causes of oral and dental diseases, methods of tooth cleaning, types, and benefits of using toothpaste in relation to respondents' oral health status

Scoring of perceived causes of oral and dental diseases, methods of tooth cleaning, types, and benefits of using toothpaste		*DMFT Index*				
		Low	*Moderate*	*High*	*Total*	χ^2 (p)
Poor perception	Count	26	55	91	172	3.176 (0.204)
	% within Scoring	15.12	31.98	52.91	54.26	
Good perception	Count	21	60	64	145	
	% within Scoring	14.48	41.38	44.14	45.74	
Total	Count	47	115	155	317	
	% within Scoring	14.83	36.28	48.90	100	
Scoring of perceived causes of oral and dental diseases, methods of tooth cleaning, types, and benefits of using toothpaste		*OHI-S Index*				
		Excellent oral hygiene	*Good oral hygiene*	*Fair oral hygiene*	*Poor oral hygiene*	*Total*	χ^2 (p)
Poor perception	Count	14	65	84	9	172	17.097* (0.001)
	% within Scoring	8.14	37.79	48.84	5.23	54.26	
Good perception	Count	12	87	41	5	145	
	% within Scoring	8.28	60.00	28.28	3.45	45.74	
Total	Count	26	152	125	14	317	
	% within Scoring	8.20	47.95	39.43	4.42	100	
Scoring of perceived causes of oral and dental diseases, methods of tooth cleaning, types, and benefits of using toothpaste		*PMA Index*					
		No gingivitis	*Mild gingivitis*	*Moderate gingivitis*	*Severe gingivitis*	*Total*	χ^2 (p)
Poor perception	Count	15	43	57	57	172	17.976* (0.000)
	% within Scoring	8.72	25.00	33.14	33.14	54.26	
Good perception	Count	21	62	28	34	145	
	% within Scoring	14.48	42.76	19.31	23.45	45.74	
Total	Count	36	105	85	91	317	
	% within Scoring	11.36	33.12	26.81	28.71	100	

*P < 0.001

OHI-S ($\chi^2 = 17.097$*, $p = 0.001$) and PMA Index ($\chi^2 = 17.976$*, $p = 0.000$), while no statistical difference was recorded pertaining to dental caries ($\chi^2 = 3.176$, $p = 0.204$). Results disclosed that 48.84% of mothers with fair oral hygiene had poor perception. In addition, the sharing women with poor perception suffered from moderate and severe gingivitis (33.14%, both).

Table 9 represents Pearson's correlation coefficient between different studied variables. The results revealed strong negative correlation between the level of education of the contributing women and their oral health condition in the form of caries measurement (DMFT index), oral hygiene (OHI-S index), and gingival status (PMA index), as the high educated participants had better oral health status (low OHI-S and PMA indices scores) and low caries index. In addition, a strong correlation was detected between level of education and "Scoring of knowledge of mothers' about causes of oral & dental problems as well as their attitude toward oral health" and "Scoring of knowledge, attitude & practices of participants about their infants' oral health." Furthermore, regarding the oral health status of the participants evaluated through the OHI-S and PMA indices, a negative correlation was obtained with "Scoring of mothers' perception and practices of oral health during pregnancy" and "Scoring of Perceived causes of oral & dental diseases, methods of tooth cleaning, types and benefits of using toothpaste."

DISCUSSION

Pregnancy and pregnant women create an exceptional challenge to dentists, not only for the reason of some oral alterations as consequences of the physiological alterations that arise during pregnancy but also the general as well as the oral health of their fetus in the stages of growth do become a matter of interest.[31] Emerging evidence has revealed that periodontal disease may be related with pre-term low birth weight,[32] growth retardation,[33] and preeclampsia.[34] It is important to evaluate the knowledge and attitudes of expectant and lactating mothers regarding different items concerned with infant oral health.[35] As mothers are the child's primary caregiver, they should be sufficiently subjected to oral health care issues that will be eventually conveyed to the child.[36] Parental behavioral aspects govern the oral health condition of their children and consequently they should be sufficiently well-informed on prevention of oral diseases.[37] This should be achieved during the first 2 years of the child's life, which is the most influential period.[38] Outcome from this study revealed that the participating women had fair oral hygiene (mean OHI-S index = 1.35), moderate gingivitis (mean PMA index = 1.39) as well as moderate caries index (mean DMFT index = 10.37) with a negative correlation between the level of education and the oral health status of the participants, as the higher the level of education of mothers, the better the oral conditions and low caries index. The decayed component contributed maximum in the DMFT index meaning that they have unmet restorative treatment needs. These results are not in accord with that of a previous study carried out among Saudi pregnant women[39] in which dental restorations were the most repeatedly registered treatment received by these antenatal ladies.

With regard to the oral health perception and practices, the participants in the current study displayed poor perception and practices on the subject of their oral health throughout pregnancy. Flossing was not regularly performed by the participants; most of them declared that they never flossing, this may be due to insufficient knowledge, absence of motivation, little time, and deficiency of skill. These results are in accord with that previously reported by Fadavi et al,[15] where they found that the pregnant African American and Hispanic women had restricted knowledge of oral health practices as tooth brushing and flossing. Moreover, in the current study, tooth flossing (0.95%) is found to be less often than brushing (43.85%), which is consistent with earlier studies.[15,40] Nearly half of the participants practicing tooth brushing twice per day; the results are to somewhat more than that was reported by Abiola et al.[18] These findings explain the prominence of "good" or "fair" oral hygiene of the mothers. On the contrary, the contributors suffered from mild gingivitis that may be as a result of ignoring flossing. A negative correlation was registered between the oral health status of the participants evaluated through the OHI-S and PMA indices and oral health perception and practices score. Results of the present study showed that the contributing females possessed high DMFT score whether they revealed poor or good perception and practices for their oral health during pregnancy, meaning ignorance of proper methods of dental care, though some of them had the necessary information, they did not correctly apply it and consequently caries occur. Also, the minority of the expectant mothers (29.65%) did not take action if they discover carious teeth in the course of pregnancy and hence the problem is intensified.

It is essential to maintain good oral health throughout pregnancy, as the mother's oral health has an influence on her baby's oral health. High levels of the cariogenic bacteria specifically MS, overt carious lesions, and inadequate oral hygiene in mothers are all documented as risk factors in the transmission of MS from the mother to her infant[41]; this early colonization of the baby's oral cavity by cariogenic bacteria can initiate early caries. In the current study, the majority of the studied women

Table 9: Pearson correlation coefficient in study groups according to different studied variables (N = 317)

		Level of Education	*Caries Measurement (DMFT Score)*	*OHI_S Index*	*PMA Index*	*Scoring of perception and practices of oral health during pregnancy*	*Scoring of knowledge about causes of oral & dental problems as well as attitude toward oral health*	*Scoring knowledge, attitude, and practices about infants' oral health*	*Scoring of Perceived causes of oral and dental diseases, methods of tooth cleaning, types, and benefits of using toothpaste*
Level of Education	r								
	p								
Caries Measurement (DMFT Score)	r	–0.141*							
	p	0.012							
OHI_S Index	r	–0.478**	0.395**						
	p	0.000	0.000						
PMA Index	r	–0.378**	0.348**	0.529**					
	p	0.000	0.000	0.000					
Scoring of perception and practices of oral health during pregnancy	r	0.252**	–0.034	–0.160**	–0.129*				
	p	0.000	0.549	0.004	0.022				
Scoring of knowledge about causes of oral and dental problems as well as attitude toward oral health	r	0.186**	–0.047	–0.074	–0.138*	0.320**			
	p	0.001	0.403	0.186	0.014	0.000			
Scoring knowledge, attitude, and practices about infants' oral health	r	0.423**	–0.046	–0.321**	–0.170**	0.101	0.215**		
	p	0.000	0.412	0.000	0.002	0.072	0.000		
Scoring of Perceived causes of oral and dental diseases, methods of tooth cleaning, types, and benefits of using toothpaste	r	0.328**	0.008	–0.194**	–0.195**	0.264**	0.072	0.243**	
	p	0.000	0.890	0.001	0.000	0.000	0.204	0.000	

*Correlation is significant at the 0.05 level (2-tailed); **Correlation is significant at the 0.01 level (2-tailed)

had a poor knowledge about the transmission of cariogenic bacteria from the mother to her baby through intimate contact. Results of this study are in accord with that reported by Kumari et al,[42] Sakai et al,[43] Suresh et al,[44] and Chacko et al.[45] The study verified that the pregnant females realized that pregnancy is a cause of gum problems (64.35%), while the minority of mothers recognized that pregnancy predisposes to tooth loss (36.59%). These findings are better than that registered in a previous study carried out by Abiola et al.[18] Moreover, less than half of the participants registered that dental visits are necessary during pregnancy that is less than found in a previous study.[18] In addition, less than half of the contributors revealed that they had visited the dentist previously, these results are in accord with the findings of Oredugba et al.[36] The respondents in the current study expressed positive attitude toward their oral health, where the vast majority of them (96.21%) agreed that keeping the natural dentition is an important issue, and more than three quarters of them did not agree that every painful tooth should be removed, while less than half of mothers reported that fruits and vegetable have an effect on the teeth and gums. These opinions are opposite to that found by Abiola et al[18] in their previous study. In the current study, it was discovered that a significant number of the participants with poor knowledge about causes of their oral and dental problems and negative attitude toward oral health being from the higher educational level than those from the lower educational level reflecting the need to increase dental awareness among various segments of the society, including the high-educational category.

It was encouraging that the majority of mothers (71.29%) could recall the time of eruption of their child's first tooth into the mouth. The findings were in accord with that of Mani et al,[46] yet contradictory to results discovered by Nagaraj et al.[35] When the mothers were inquired about saliva-sharing behavior with their babies, their knowledge was poor and consequently their practices were faulty concerning sharing with the baby spoons or other utensils and method of cleaning of dropped pacifier or toy. In addition, only 38.80% of women be certain that the gum pads of their children should be cleaned using wet gauze. This finding is in agreement with previous studies carried out by Nagaraj et al[35] and Chan et al.[47] With regard to infant-feeding practices, it was optimistic to discover that the vast majority of mothers (82.33%) did not use sweetened pacifier. The low prevalence of using sweetened pacifier was an encouraging finding because the use of sweetened pacifier is an ascertained factor in etiology of nursing caries. This result is higher than that reported previously.[35] The terrifying finding pertaining to the presence of the burden of nocturnal bottle feeding, as only 33.75% of mothers stated that they did not follow this habit. The finding is consistent with that of Nagaraj et al.[35] Actually, a need is required to supply mothers with instructions and counseling in feeding practices. These nocturnal feeding habits are well identified to influence caries enhancement in young children. A nursing bottle at night may be used as a form of reliever so, establishing a habit that is consequently hard to disrupt, and the problem is exacerbated when these feeding bottles are containing liquids/milk sweetened with sugar. The outcome of this study illustrated poor knowledge of the participating mothers considering their child's visit to the dentist. In the present study, only 12.30% of the contributors recognized that a child's first visit to the dentist should be when the first (milk) tooth erupts. Rather, just 23.34% of participants considered that the child's dental visit should be for routine check-up twice a year. This perception is comparable to that reported by Eigbobo et al.[7] Good oral hygiene practices are created once the child is born; the oral cavity is regularly cleaned even before tooth eruption. The American Academy of Pediatric Dentistry (AAPD) recommends that parents should commence cleaning the child's teeth as their first tooth erupts.[3,48] A very soft toothbrush may be used to clean teeth.[48,49] Also, it is valuable for mothers/caregivers to help their children in brushing their teeth till the child has the dexterity to remove plaque successfully by themselves and this is as the child reached 8-10 years old.[49,50] Results of this study revealed that although the contributing mothers had high and middle levels of education, they did not have sufficient knowledge of oral health care as represented by their poor oral care practices where just 17.98% of them started cleaning their child's teeth when the first milk tooth erupts, this is much lesser than what was found previously.[7,51] Merely 17.03% reported that they use small soft round nylon wet toothbrush without toothpaste to clean their baby's teeth, which is contrary to previous studies.[7,52] Furthermore, only 11.10% of them indicated the ideal age, 8 years, as the age that children should start brushing by themselves; this is to somewhat near to what was reported by Szalewska et al[51] and Eigbobo et al.[7]

Findings from this work revealed a negative correlation between the oral health status of the participants evaluated through the OHI-S and PMA indices and "Scoring of Perceived causes of oral & dental diseases, methods of tooth cleaning, types and benefits of using toothpaste." The majority of the participants perceived the correct causes of dental caries as sugar/sweet foods (88.96%) as well as poor oral hygiene (79.118%), while a lesser percentage perceived the causes of gum diseases (calculus/tartar 46.06% and poor oral hygiene 57.10%). From the results, it seems that the participating group did not have enough knowledge about bacterial plaque

as one of the causes of dental caries and periodontal diseases. Concerning the causes of dental caries, the current findings are higher than that reported in previous studies,[36,52] whereas for the causes of periodontal diseases, the present results are similar to that of Oredugba et al,[36] yet in contrast to the 20% in the former study by Orenuga and Sofola.[52] Enquiry about the appropriate methods used daily for tooth cleaning to prevent dental diseases; it was encouraging to find that the vast majority of mothers (87.07%) preferred to use toothbrush and toothpaste, which is consistent with Abiola et al[18] where they found that 94.2% of pregnant women use toothbrush. For the types of toothpaste, only half of ladies perceived the fluoridated toothpaste; this is less than what was registered by Al-Turck[39] where 82% used regular fluoride toothpaste. Miswak chewing sticks were chosen to be used by 42.59% of women; this result is in accord with the findings of Al-Turck,[39] and in contrast with that of Abiola et al.[18] On the contrary, the participants registered lack of perception regarding the use of dental floss and other interdental cleaning aids as well as mouth rinses as methods of tooth cleaning. The results are slightly higher than that reported in a previous study[39] where only 18% of the participants stated that they use mouthwash daily. Most of the contributing women (81.70%) believed that toothpastes are beneficial predominantly to prevent dental caries and 76.34% perceived that they make the mouth clean and fresh; this is inconsistent to what was discovered previously.[18]

CONCLUSION

Based on the findings of the current study, mothers exhibited fair oral hygiene, moderate gingivitis, and moderate caries index with a significant difference and strong negative correlation between the level of education and the oral and dental health as the higher the educational level the better the oral condition. Poor perception and practices were recorded regarding mothers' oral health during pregnancy. Flossing was not habitually implemented. Almost half of the participants performing tooth brushing twice per day. High DMFT score was presented whether women disclosed poor or good perception and practices for their oral health throughout pregnancy. Furthermore, the minority of the ladies did not yield action if they realize carious teeth during pregnancy and consequently the problem is exaggerated. A negative correlation was recorded between OHI-S and PMA indices and oral health perception and practices score. A considerable number of mothers with poor knowledge about causes of their oral and dental problems and negative attitude toward oral health were from the higher level of education revealing the necessity to increase dental awareness among various categories of the community, comprising the high-educational segment. The vast majority of the contributors owned poor knowledge and practices in addition to negative attitude concerning their infants' oral health. In relation to the level of education, less than one quarter of the mothers with low educational level had poor knowledge and practices along with negative attitude, which means that although the sharing mothers had high and middle levels of education, they maintained poor knowledge and practices and negative attitude about their infants' oral health. With regard to perception about causes of oral and dental diseases, methods of tooth cleaning, as well as types and benefits of using toothpaste, poor perception was detected among the participants with a negative correlation with the OHI-S and PMA indices.

RECOMMENDATIONS

- Incorporating oral health education programs and pediatric education for oral health as part of pre- and postnatal care may enhance perception and practices regarding the importance of oral health measures among expectant and lactating mothers, thus improving their oral health and consequently that of their infants.
- Dental health care workforces should be incorporated into the pre- and postnatal clinics to provide oral and dental health education with regard to the best time to receive oral treatment during pregnancy, causes of oral and dental diseases, and methods of tooth cleaning, as this is the instance at which women are willing to accept new information.
- Implementation of sensitization programs to raise the mothers' awareness concerning prenatal and pediatric dental counseling to confirm that infants' dental visits should begin with the appearance of a child's first tooth as the recommendations of the American Academy of Pediatric Dentistry (AAPD), and the appropriate methods of saliva-sharing behavior with the baby as well as child's oral cleansing methods.

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CASE REPORT

Is Resection a Panacea for managing Furcation Predicament? A Report of Two Cases

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ABSTRACT

The presence of attachment loss in the furcation is one of the most serious anatomical sequels of periodontitis. Furcations are not accessible for professional debridement, as their entrance is small compared with the size of periodontal instruments, and they present with ridges, convexities, and concavities that make it difficult for clinicians to debride effectively. Advances in dentistry have provided the opportunity for clinicians to provide patients with the option of retaining their teeth in the long term. Such teeth can be useful as independent units of mastication or as abutments in simple fixed bridges. This article presents two cases of advanced furcation defects, which were treated by two different resective periodontal therapeutic modalities.

Keywords: Furcation, Resective, Tunneling.

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BACKGROUND

Furcation involvement is defined as bone resorption and attachment loss in the interradicular space that results from plaque-associated periodontal disease.[1] The management and long-term retention of molar teeth with furcation involvement has been a challenge for clinicians since time immemorial. Owing to the complex anatomy of multirooted molar teeth characterized by ridges, concavities, bifurcation ledges, cervical enamel projections, and other developmental anomalies present in the furcation region,[2] accessibility to the furcation area is impeded for professional root debridement.[3] The arduous nature of furcation sites spells doom for molar teeth, as they respond less favorably to conventional periodontal treatment than their respective flat surfaces.

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In spite of this, the decision to retain and treat teeth with furcation involvement has been recognized as a feasible and predictable modality when appropriate treatment parameters are addressed.[4-6] Survival rates of teeth affected with furcation defects, after regenerative and resective therapy, have ranged from 83 to 100%, as observed over a period of 5 years.[7]

Glickman has classified furcation involvement into four grades as follows: Grade I – incipient involvement with suprabony pocket and no radiographic evidence of bone loss, Grade II – cul – de – sac involvement, Grade III – through and through furcation involvement with soft tissue covering the furcation entrance, and Grade IV – through and through furcation involvement with exposed furcation entrance. Among the following, Grade III and Grade IV involved furcation are considered to have poor to hopeless prognosis, as instating plaque control measures to clean these inaccessible areas is impossible and extraction of such teeth in near future becomes mandatory. With the introduction of resective therapies for treating advanced furcation defects since the past 20 years, compromised teeth can be rejuvenated and upgraded to a status of fair prognosis.[8] Moreover, the long-term success rate of these surgically managed teeth (96.7%; 701 molars) is abreast with the survival rates of dental implants (97%; 1472 implants).[9] In comparison to rehabilitation with implants, effectively treating a furcation has shown to be less invasive, cost-effective, retain the proprioception of periodontal ligament, and require fewer appointments.

The treatment options available for teeth with advanced furcation involvement involve regenerative and/or resective approaches. Various resective procedures described in literature are hemisection, radisection, bicuspidization, and tunneling. Root resection is the process by which one or more of the roots of a tooth are removed at the level of the furcation, while leaving the crown and remaining roots in function.[10] It can be vital root resection[11] or nonvital root resection.[12] Tunnel preparation is the intentional widening of the furcation entrance, making it amenable and accessible for performing oral hygiene procedures.[13]

This article brings to you a report of two cases of advanced furcation defects managed successfully with resective periodontal surgical procedures.

CASE REPORT 1

A 60-year-old male patient reported to the Department of Periodontics at MGM Dental College and Hospital with a complaint of pain in his left lower posterior region since 1 month. The pain was dull and throbbing, with no associated relieving or aggravating factors. Patient had no history of systemic involvement such as presence of diabetes mellitus, hypertension, and immuno-compromised condition. Clinical examination revealed fair oral hygiene status and the presence of Grade-IV furcation involvement in left mandibular first permanent molar (36) as diagnosed with a Naber's probe (Fig. 1) and wear facets due to presence of traumatic occlusion. Radiographic examination revealed adequate bone present expect in the furcation region (Fig. 2). Phase I therapy comprised thorough scaling and root planing to eliminate local factors along with coronoplasty (to correct traumatic occlusion) and oral hygiene instructions were given. Vitality testing of 36 with ethyl chloride spray (cold test) and electric pulp testing revealed delayed response. Hence, endodontic treatment was carried out prior to periodontal surgical procedure. On subsequent follow-up visits, it was noted that the open furcation site of 36 was acting as a nidus for accumulation of local irritants in spite of overall good oral hygiene maintenance. Hence, the option of resective therapy was considered and a treatment plan was formulated to perform tunneling procedure so as to modify the furcation dilemma into a self-cleansable area.

Following administration of local anesthetic agent (2% lignocaine with 1:2,00,000 adrenaline), a full-thickness mucoperiosteal flap was reflected for the mandibular left posterior sextant (Fig. 3). Thorough debridement and root planing were performed and odontoplasty in the furcation site was done using diamond abrasive strips (coated with 15 µm diamond particles, 3M ESPE Dental Products, Mumbai, India) (Figs 4 and 5), the endpoint of which corresponded to an increase in space adequate enough for passage of an interdental brush easily through the furcation region (Fig. 6). Sharp bony

Fig. 1: Preoperative clinical view showing grade IV furcation involvement with 36

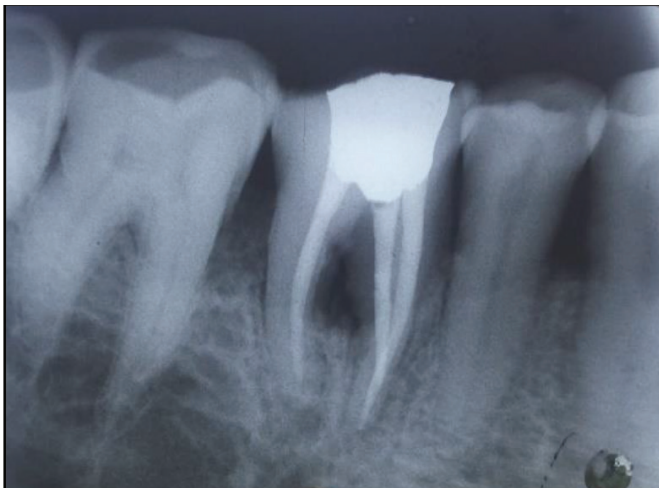

Fig. 2: Radiograph after root canal treatment with 36

Fig. 3: Full thickness mucoperiosteal flap raised

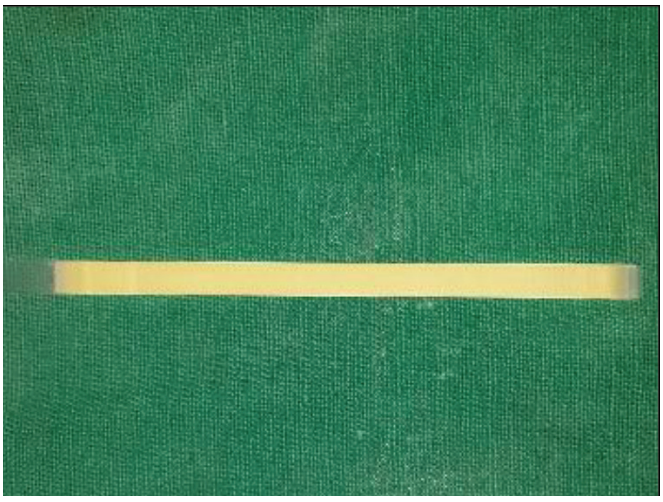

Fig. 4: Diamond abrasive strip

Fig. 5: Odontoplasty with diamond abrasive strip in the furcal area

Fig. 6: Tunnel preparation completed

Fig. 7: Sutures placed

margins and ledges were recontoured to achieve a near-normal architecture. The flap was then apically repositioned and interrupted direct loop sutures were given using 3-0 black silk suture (Fig. 7). Drug regimen postoperatively was composed of antibiotic – Amoxicillin 500 mg thrice daily with an anti-inflammatory drug with a combination of diclofenac sodium, acetaminophen, and serratiopeptidase twice daily for a period of 5 days. Patient was also instructed to rinse twice daily with 10 ml of 0.2% chlorhexidene gluconate for 2 weeks. Suture removal was done 1 week postoperatively. On a monthly follow-up visit, the patient reported with no discomfort and healing was found to be satisfactory (Figs 8 and 9).

CASE REPORT 2

A 36-year-old male patient reported to the Department of Periodontics at MGM Dental College and Hospital with difficulty in chewing food from his upper left back tooth region since past 9 months. Patient was systemically healthy. Intraoral examination revealed fair oral hygiene status with presence of bleeding on probing along with deep periodontal pockets present in relation to 25, 26, and 27. In the area of the chief complaint, an 8-mm probing pocket depth was present with the distobuccal aspect of maxillary left first permanent molar (26) along with Grade I mobility (Fig. 10). Radiograph revealed interproximal bone present only in the apical third of the distal aspect of 26 (Fig. 11). The tooth was diagnosed to be nonvital, as it failed to respond to testing with ethyl chloride spray (cold test) and electric pulp testing. Hence, root canal treatment was completed prior to surgical intervention.

With respect to resective periodontal surgical procedure, the distobuccal root in maxillary molars is the preferred alternative for root resection, as it is the shortest of the three roots with oval cross section, invested in a small quantity of bone.[13] Comparatively, the mesiobuccal root has a larger root surface and is centrally located with premolars, creating ideal position to function as a


Fig. 8: One month postoperative clinical view with use of interdental brush

Fig. 9: One month postoperative radiograph

Fig. 10: Preoperative clinical view showing 8mm probing depth

separate unit [14]. With all these points in consideration, a distobuccal root resection was planned. A full-thickness muco-periosteal flap was reflected in relation to 25, 26, and 27 (Fig. 12) after administration of local anesthetic agent (2% lignocaine with 1:2,00,000 adrenaline). Exposure of the surgical site revealed complete loss of bone on the distal aspect of distobuccal root of 26 along with interradicular bone loss. The cementoenamel junction was identified and the confluence of the distobuccal root with the root trunk was marked with an indelible pencil that served as a guide for the initial cut to be made with a diamond coated cylindrical bur (Fig. 13). Care was taken not to damage the adjacent root structure by inserting wooden wedges in the trifurcation area. After completion of the cut, the resected root was gently luxated out with a periosteal elevator (Figs 14 and 15). The remnant

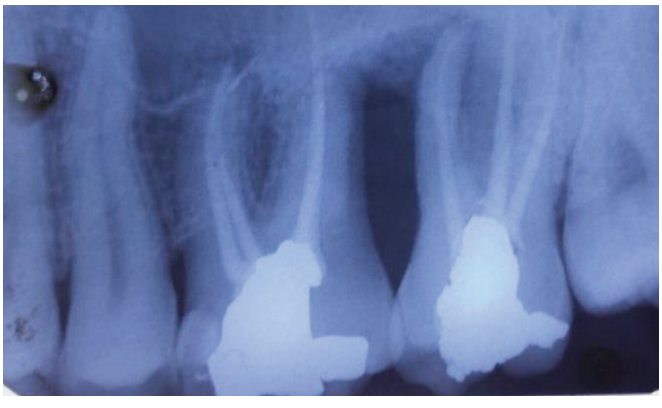

Fig. 11: Radiograph after root canal treatment of 26&27

Fig. 12: Full thickness mucoperiosteal flap raised with selection of distobuccal root for resection

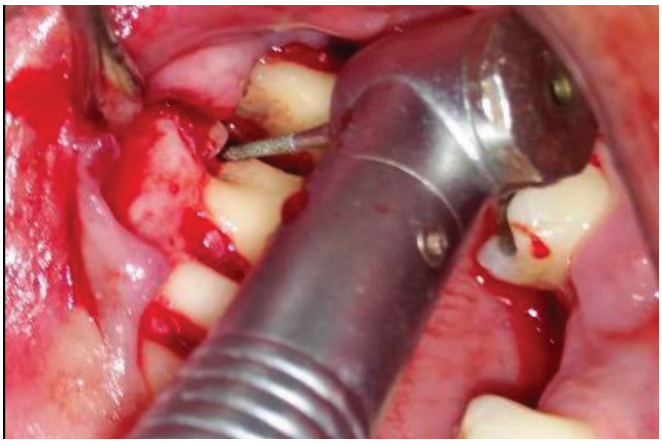

Fig. 13: Use of diamond coated bur for root resection

Fig. 14: Perioperative view

Fig. 15: Resected distobuccal root

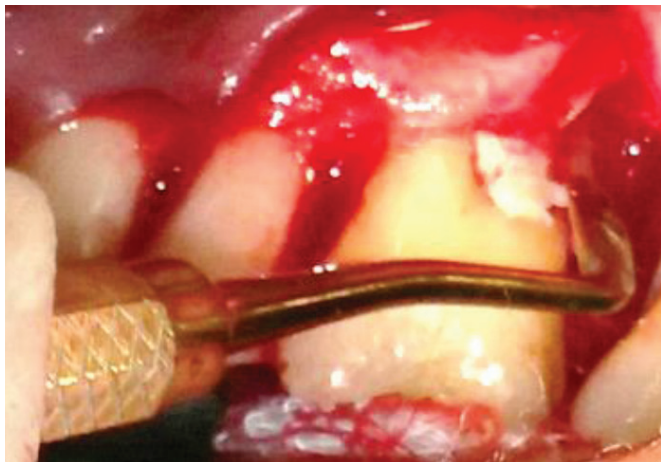

Fig. 16: GIC application on stump of resected root

stump of distobuccal root was sealed with glass ionomer restorative cement (GC Fuji II, Mumbai, India) (Fig. 16) for sealing off the exposed dentinal tubules. The mobility of the remaining tooth root complex was checked. Flap closure was done using interrupted direct loop suture with 3-0 black silk (Fig. 17). Drug regimen postoperatively was composed of antibiotic – Amoxicillin 500 mg thrice daily with an anti-inflammatory drug with a combination of diclofenac sodium, acetaminophen, and serratiopeptidase twice daily for a period of 5 days. Patient was also instructed to rinse twice daily with 10 ml of 0.2% chlorhexidine gluconate for 2 weeks. Suture removal was done after 1 week. Follow-up visits were scheduled and the surgical site showed favorable healing and absence of mobility by the 6th month (Figs 18 and 19).

Fig. 17: Sutures placed

Fig. 18: 6 month postoperative clinical view

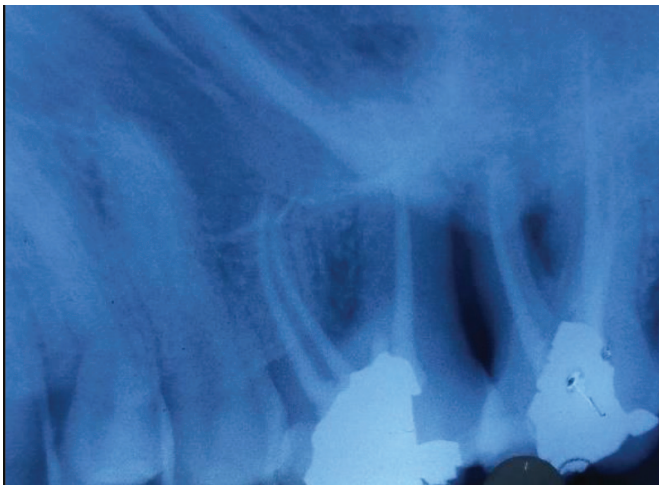

Fig. 19: Six month postoperative radiographic view

DISCUSSION

Furcation defects represent a formidable problem in the control and treatment of periodontal disease, principally related to the complicated, unpredictable, and irregular anatomy of furcation. The anatomical characteristics of the areas involved, particularly the size of the furcation entrance, the presence of root concavities, and the uneven surface of the roof of the furcation, make adequate instrumentation of the inter-radicular area extremely difficult.[15] Resective therapies in these scenarios have proved to be a boon to salvage natural teeth and thus retain the proprioception of periodontal ligament. Success of root resection procedures depends on proper case selection. Both cases presented were carefully evaluated and all treatment options were deliberated upon before deciding on the resective form of therapy. The justification of resecting tooth/root structure was aimed at making the tooth amenable to regular plaque control measures. In Case 1, the interradicular distance was not wide enough preoperatively, and hence, a tunneling procedure was planned that made the passage of interdental brush for oral hygiene maintenance possible. Mandibular molars, unlike their maxillary counterparts, cannot serve as successful candidates for root resection in purview that the remnant tooth root complex has less pericemental area to effectively bear the occlusal forces, thus compromising their functional surveillance in the long run.[16] Hence, root resection alone is not a feasible option for birooted mandibular molars. Also, the preoperative attachment loss present on the tooth concerned ruled out any other resective form of therapy expect for the chosen one. Furthermore, there was sufficient interproximal bone present, which enabled conservative removal of bone and tooth structure in the furcal region without adversely affecting the attachment apparatus, and thereby securing a long-term prognosis for the tooth. The preparation of tunnel was confined to odotoplasty done using diamond abrasive strips that limited the compromise of sound tooth structure that could occur with rotary instruments. One commonly reported drawback associated with the tunneling procedure is the development of root caries.[17] To prevent this, a fluoride-containing mouth wash was prescribed to the patient 1 month after surgery.

In Case 2, the distobuccal root demonstrated maximum attachment loss and on surgical entry was found to be round. Owing to the proximity of distobuccal root of first molar to the mesiobuccal root of second molar, it was decided to resect this root to prevent further breakdown in this area.[18] Also, on radiographic examination, the tooth demonstrated sufficient crown: root ratio with adequate length and width of the mesiobuccal and palatal roots that could sustain the occlusal load in the event that distobuccal root was resected.

In both the cases discussed above, the logical sequence of treatment mandated completion of endodontic treatment prior to resective periodontal surgery, as the endodontic periodontic continuum could result in exacerbation of the periodontal inflammation. In a study by Park et al,[19] it was concluded that molars that underwent resective procedures due to periodontal reasons had a higher success rate than those due to endodontic causes. These procedures were able to remove periodonthopathic microorganisms, calculus, unfavorable anatomic contours, hemiseptal defects, and deep intrabony defects.[20]Another important factor that was given special consideration was the initial bone level present on molar roots to be salvaged. It has been shown that molars with bone support on more than 50% of the remaining roots at the time of the surgical procedure have better survival rate if the etiology was due to periodontal disease,[20] as was considered during formulation of our treatment plan.

An important patient-related factor in resective periodontal procedures is the maintenance of high levels of oral hygiene by the patient. In the cases shown, the patients were able to ensure adequate plaque control. A meta-analysis by Huynh-Ba et al[21] inferred that multirooted teeth with furcation involvement treated with resective surgical approach had good survival rates over a period of 10 to 15 years.

CONCLUSION

The present case reports help us to understand that resective therapies are sound treatment alternatives for teeth with advanced furcation defects, as they effectively maintain the natural teeth in function, keeping intact the proprioception of periodontal ligament. Perfect compliance of the patient with plaque control and the

cost–benefit calculations speak in favor of this treatment. These therapies have successfully proven to be an effective treatment alternative to extraction and can provide a breath of life for teeth with ailing furcations.

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CASE REPORT

Juvenile Aggressive Trabecular Ossifying Fibroma of Mandible: A Rare Case Report

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ABSTRACT

Fibroosseous lesions of the jaws, including juvenile ossifying fibroma (JOF), pose diagnostic and therapeutic difficulties due to their clinical, radiological, and histological variability. There are two histological varieties of it, one as psammomatoid type and second as trebacular type; here, we present a trebacular type, which is a rare variety. After the clinical examination, radiological and histological analysis, it was diagnosed as juvenile trebacular ossifying fibroma. Although JOF is an uncommon clinical entity, its aggressive local behavior and high recurrence rate means that it is important to make an early diagnosis, apply the appropriate treatment, and, especially, follow-up the patient over the long term.

Keywords: Fibroosseous lesions of the jaw, Juvenile aggressive trabecular ossifying fibroma, JOF.

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INTRODUCTION

Fibroosseous lesions of the cranial and facial bones are usually benign and tend to grow slowly. Benign fibroosseous lesions have histopathological features similar with fibrous dysplasia, ossifying fibroma, and cemento-ossifiying dysplasia.[1, 2]

Ossifying fibroma, a rare tumor entity, is a well-demarcated, benign, fibroosseous tumor with capsule composed of metaplastic bone, fibrous tissue, and varying amounts of osteoid.[3-5] The ossifying fibromas are subdivided into conventional and juvenile clinicopathologic subtypes.[3] Conventional ossifying fibromas are usually slow growing and generally seen in the 3rd and 4th decades of life.[6, 7] They are treated with simple curettage and the recurrence is rare.[8] It affects people of all ages, but in contrast to the form seen in adults, the juvenile form is clinically more aggressive and tends to be recurrent.[3]

According to the new edition of the classification of the World Health Organization,[9] ossifying fibromas that appear as fast growing mass between 5 and 15 years of age, radiologically well bordered, and consistent with ossifying fibroma histologically, are referred as juvenile ossifying fibroma (JOF).

Juvenile ossifying fibroma appears at an early age and in 79% of the patients is diagnosed before the age of 15.[2, 3, 10] Males and females are equally affected.[11] Juvenile ossifying fibroma originates from periodontal ligament and accounts for 2% of oral tumors in children.[12,13] The JOF is located mainly (85%) in facial bones, in some cases (12%) in calvarium, and very seldom (3%) extracranially.[2] Ninety percent of the lesions located in the face region involve the sinuses, mainly the maxillary antra.[2] Mandibular lesions are seen in 10% of the cases.[2, 14] The tumor is well circumscribed by a tiny sclerotic shell of bone. It appears locally aggressive with cortical disruption and involvement of many adjacent anatomical structures. This lesion has predominating soft tissue consistency with variable amounts of internal calcification and/or linear or irregular focal bone.[2] It usually shows a low density mass due to cystic changes on computed tomography (CT) scans. Following intravenous injection of iodinated contrast, the lesion may show diffuse appearance enhancement.[2]

Histologically, JOF is characterized by the presence of cellular fibrous stroma, garland-like bony strands, and cement particles.[2, 6, 11, 13] The JOFs are classified into two distinct clinicopathological entities: The trabecular and the psammomatoid types. Trabecular JOF is distinguished by the presence of trabeculae of fibrillar osteoid and woven bone and psammomatoid JOF is characterized by the presence of small uniform spherical ossicles that resemble psammoma bodies.[14, 15] Psammomatoid JOF is reported more commonly than trabecular JOF.[14, 16] Psammomatoid JOF occurs predominantly in the sinonasal and orbital bones, and trabecular JOF predominantly affects the jaws. Psammomatoid JOF has aggressive behavior and it has a very strong tendency to recur.[15-17]

An accurate diagnosis of JOF is made by correlating the clinical, radiological features, and histopathological findings.[2]

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A case of juvenile trabecular ossifying fibroma (JTOF) of the right mandible in a 34-year-old male is presented here. The rarity of the case is the age of occurrence that is unusual for JTFO, but the lesion was undetected for a long time. The lesion was so aggressive, as it caused expansile destruction of the right mandible. Very few cases of JTOF have been reported in the literature that makes this case a unique one.

CASE REPORT

A 34-year-old male patient came with a chief complaint of painless swelling in his lower right jaw since last 15 years. Patient gave history of getting hit on the jaw with a cricket ball at school 20 years back. There was pain and swelling following the trauma, but it subsided within a few days without any treatment. However, after 5 years, he noticed a small swelling about the size of a coin in the same region. He neglected it, as it did not cause any discomfort. After a few years, he noticed that the swelling gradually increased in size for about 10 years and then there was a rapid increase in the size of the swelling during the last 5 years, and has reached the present dimension. There has been no history of bleeding, discharge, and parasthesia associated with the swelling. On general examination, the patient was conscious, cooperative, and well oriented to time, place, and person. He was healthy, well-built, and well nourished. All vital signs were within the normal limits. On extraoral examination, there was a gross facial asymmetry due to a diffuse swelling on the right side of the lower face (Figs 1 to 3).

Fig. 1: Front facial profile

Fig. 2: Right lateral facial profile

Fig. 3: Expansion of the right lower face

The swelling measured approximately about 10×6 cm in size anterioposteriorly, extending from right lower para symphyseal region till 2.5 cm posterior to the right ear. Superoinferiorly, it extended from right alatragal line till 1 cm inferior to the right lower mandibular border. Skin over the swelling was tensed, shiny but without any change in color, scar, or pigmentation. On palpation, the entire inspectory findings were confirmed. The swelling was bony hard, afebrile, and nontender. A single right submandibular lymph node was palpable, tender, and mobile. Intraoral examination revealed obliteration of

Fig. 4: Intraoral view of lower right mandibular region

the right lower buccal vestibule due to the swelling, extending from 43 till the posterior aspect of 48, which on palpation was bony hard in consistency (Figs 1 to 3). The swelling expanded the buccal cortical plate with maximum expansion in relation to 47. The surface of the swelling was of normal color with no sign of discharge. Teeth in this region were normal without any pathology (Fig. 4).

Based on history and clinical examination, a provisional diagnosis of benign odontogenic tumor was given. A differential diagnosis of a fibroosseous lesion was considered.

Orthopantomogram (OPG) (Fig. 5) revealed an expansile mixed lesion on the right side of mandible. The trabecular pattern was altered from the symphyseal region extending posteriorly to the ramus expanding it. In the angle region, the expansion was globular ascending up to the ramus expanding its posterior border involving the condyle obliterating the sigmoid notch and the anterior border of ramus. The internal structure revealed mixed radiolucent radiopaque areas in the anterior aspect and posteriorly a multilocular pattern. Neither there was displacement of teeth in the region nor were the roots resorbed.

Intraoral periapical (IOPA) radiograph from 41 to 48 (Figs 6 to 8) revealed a mixed radiolucent radiopaque lesion in the periapical region with loss of lamina dura in relation to their roots. The radioopacities were patchy with diffuse radiolucent areas in between. Right mandibular lateral occlusal radiograph (Fig. 9) shows a marked expansion of buccal cortical plate from 45 to posteriorly beyond 48. Here, a homogenous radiopaque pattern with radiolucent locules in the anterior region was appreciated.

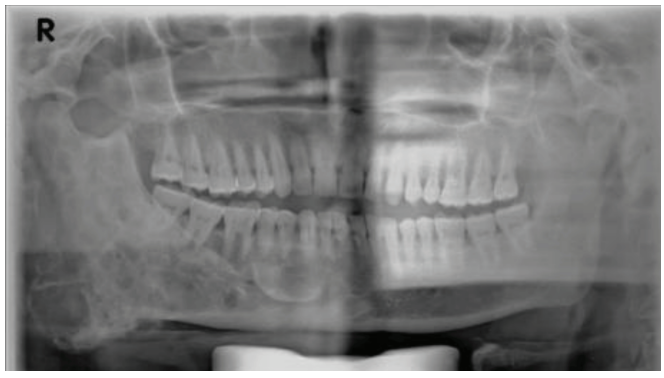

Fig. 5: Orthopantomogram

Fig. 6: Intraoral periapical – 41, 42, 43

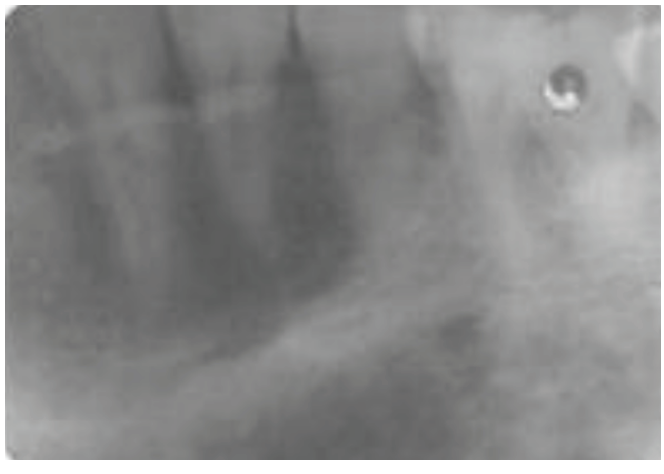

Fig. 7: Intraoral periapical – 44, 45, 46

A posteroanterior (PA) mandible view (Fig. 10) showed an expansile multilocular lesion in the right mandible with a globular expansion of the angle ascending up to the ramus to the condyle. There was irregular expansion of the anterior border of the ramus.

Axial CT scans (Figs 11 to 13) and three-dimensional (3D) reconstruction (Figs 14 to 16) images showed an

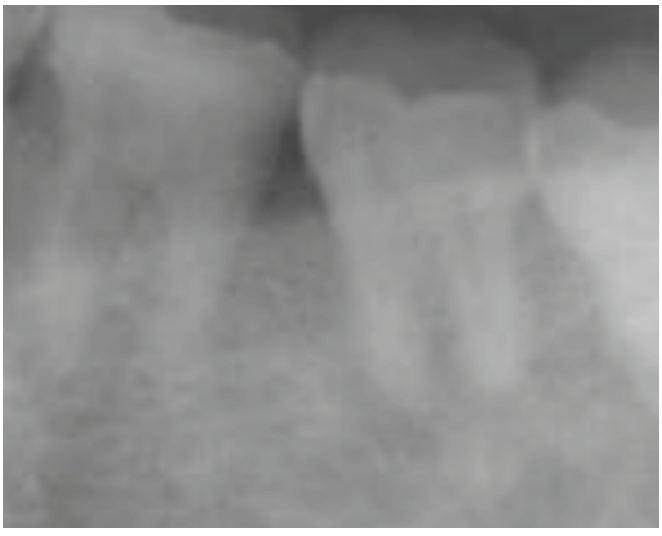

Fig. 8: Intraoral periapical – 46, 47, 48

Fig. 9: Right mandibular lateral occlusal radiograph

Fig. 10: Posteroanterior mandible

Fig. 11: Computed tomography image

expansile multilocular lesion in the right side of the mandible. The expansion was more in the buccal aspect of the mandible, exaggerated in the angle, involving the ramus, condyle, and coronoid. Small, patchy calcified masses could also be appreciated in the axial sections of CT.

Based on the radiographic pictures, a fibroosseous lesion was considered due to the multilocular radiolucent and patchy calcified areas, with a globular, centrifugal growth pattern in the angle.

A bone biopsy of the swelling revealed an aggressive type of ossifying fibroma in the mandible. Histopathologic report said the H&E section photomicrographs (Figs 17 to 19) show highly cellular connective stroma, which is composed of plump fibroblasts, collagen fibers, and many blood vessels; areas of ossification in the form of bony trabeculae and round masses of lamellar bone are seen interspersed throughout the connective tissue. Some of the trabeculae show osteoblastic rimming indicative of forming bone.

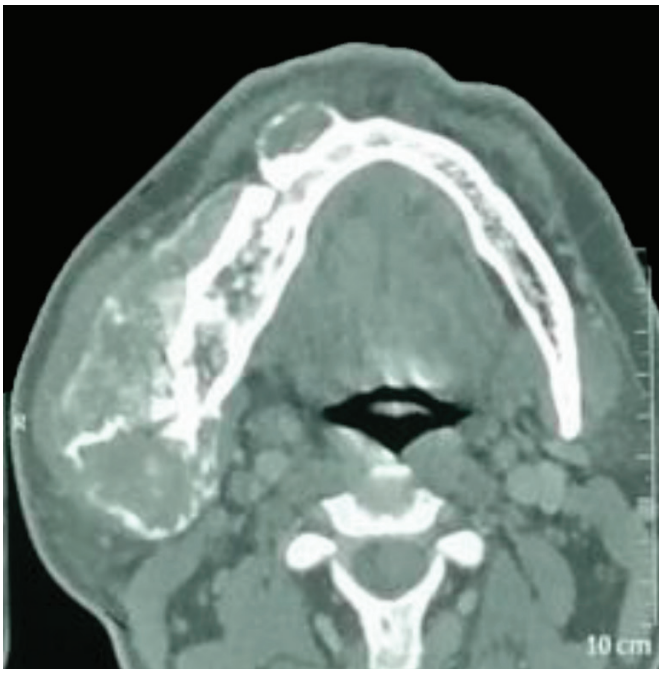

Fig. 12: Computed tomography image axial view

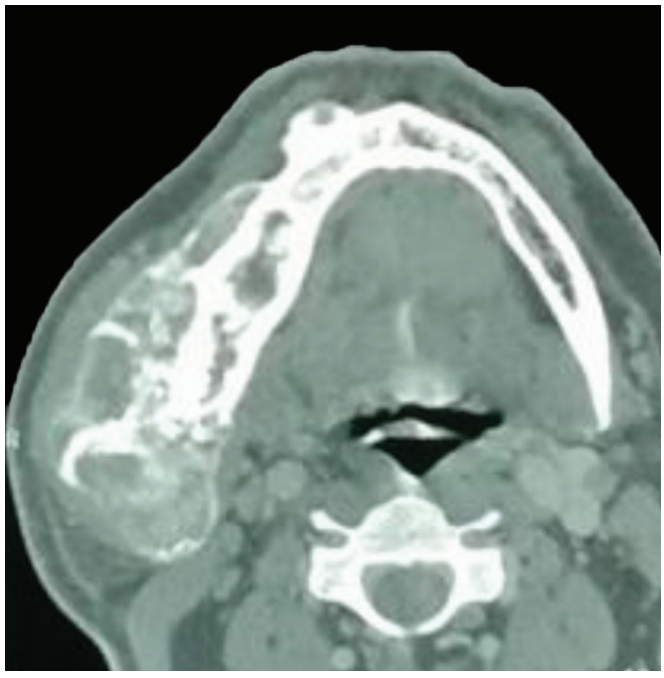

Fig. 13: Computed tomography image axial view

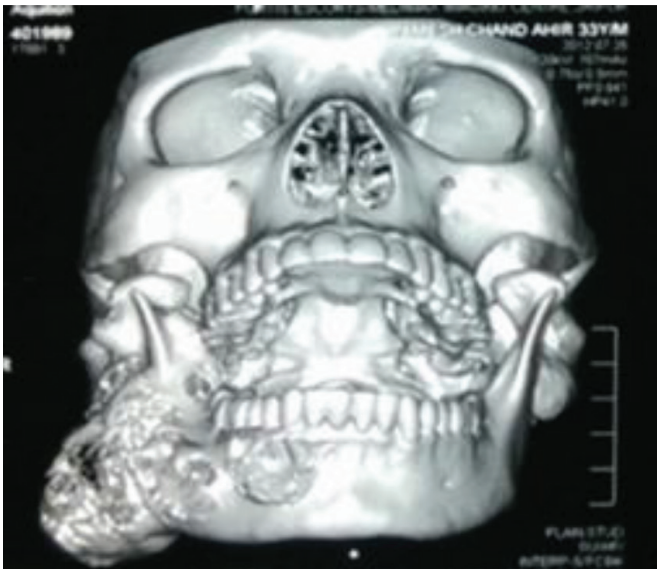

Fig. 14: Three-dimensional reconstruction frontal aspect

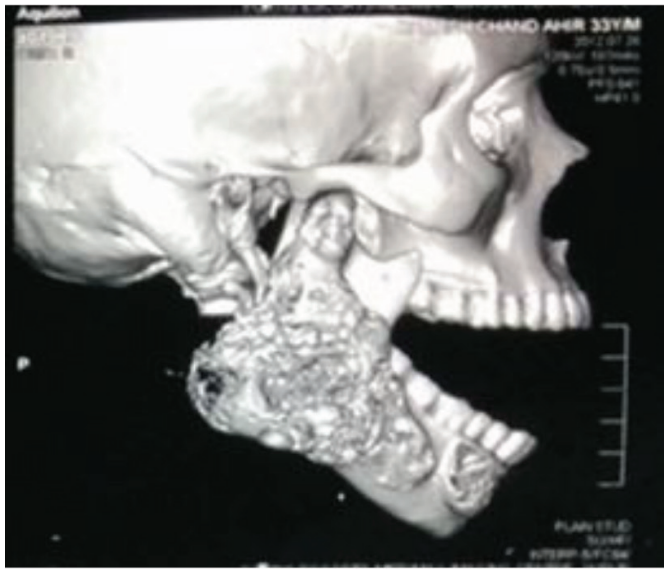

Fig. 15: Three-dimensional reconstruction lateral aspect

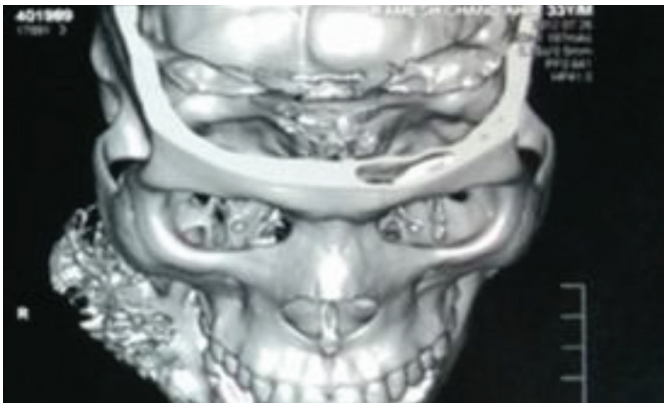

Fig. 16: Three-dimensional reconstruction frontosuperior aspect

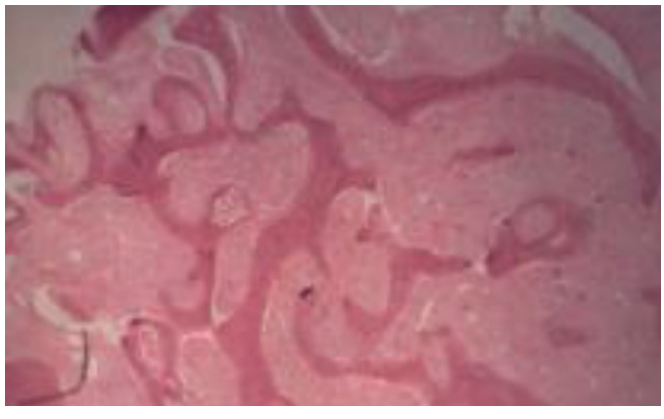

Fig. 17: Histopathology photomicrogram

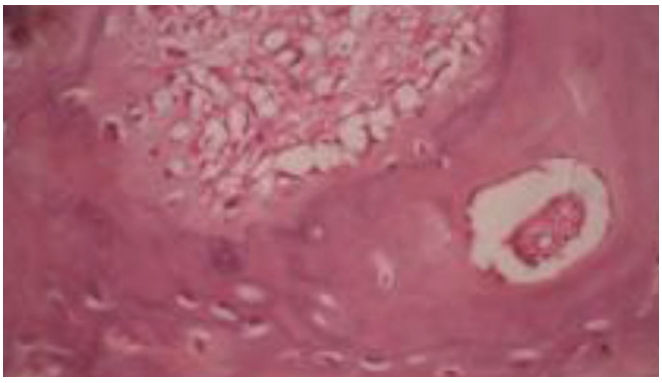

Fig. 18: Histopathology photomicrogram

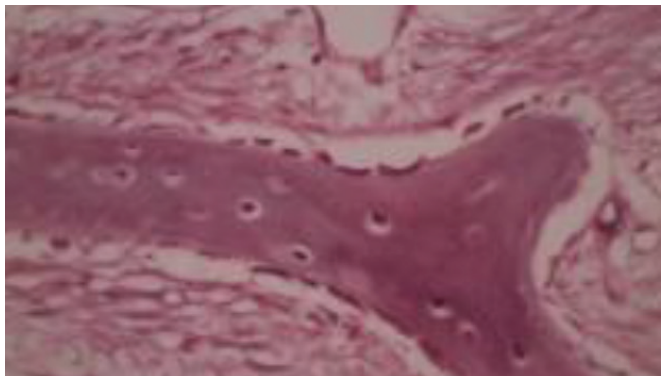

Fig. 19: Histopathology photomicrogram

DISCUSSION

Most benign fibroosseous lesions of jaws are asymptomatic and slowly progressing. Moreover, an unusual clinical presentation with apparent aggressive and destructive growth may be expected when the lesion is encountered in a younger patient.[18, 19] In our patient, the lesion was initiated at a younger age but was neglected by the patient and/or was not detected at that time.

Juvenile ossifying fibroma is a relatively rare fibroosseous lesion of the jaws characterized by its early age of occurrence, the location, radiological appearance, and the tendency to recur.[25] Juvenile ossifying fibroma affects both males and females equally without any significant gender predilection. However, some researchers report that it is more common among men.[20] The patient whose case is reported here is also a 34-year-old male. In contrast, Johnson et al[20] stated that mandibular tumors are more frequently common in girls between the age of 5 and 11 years or during the 2nd to 4th decades of life.[6]

A few cases of facial trauma have been suggested as a possible etiologic factor in the JOF development[10] as was found in this patient also.

Juvenile ossifying fibroma is characterized as an expansile, yet with well-defined sclerotic borders, locally aggressive, and destructive at cortex on CT scan. This lesion is observed as a soft tissue mass with internal calcification, linear or irregular bone foci[2, 21-23] as was observed in our case.

Ong and Siar[24] presented JOF as a progressively growing lesion that can attain an enormous size with resultant deformity if left untreated. They presented a case of large cemento-ossifying fibroma involving the left mandible in a male patient. The long-lasting history of untreated JOF resulted to spontaneous fracture of mandible. Furthermore, if JOF does not have adequate surgical treatment, it may have a high rate of recurrence.[4, 24] The recurrences are generally seen at an early stage and they are more aggressive than primary lesions.[4]

As per Table 1,[15] for differentiation of ossifying fibroma, juvenile aggressive trabecular ossifying fibroma,

Table 1: A working classification of the three clinicopathological variants of ossifying fibroma[15]

	Ossifying fibroma	*Juvenile trabecular ossifying fibroma*	*Juvenile psammomatoid ossifying fibroma*
Age (mean)	10–50 years (35)	2–30 years (10)	3 months–72 years (20)
Female: male	2:1	1.2:1	1.3:1
Site	Tooth-bearing areas Mandible 70% Maxilla 30%	Mandible 50% Maxilla 44% Sinonasal 6%	Sinonasal 62% Maxilla 20% Mandible (ramus) 10% Cranium 8%
Radiology	Well circumscribed Unilocular Variable radiopacity	Well circumscribed Speckled calcifications	Well circumscribed Expands and fills paranasal sinuses – 'aggressive pattern' tends to be radiopaque
Histopathology	Cellular fibrous tissue, storiform pattern, separate trabeculae of woven boneoccasional spherical, psammomatoid calcifications, encapsulated	Densely cellular, immature osteoid and in trabecular pattern, osteoblast rimming and cellular osteoid.	Densely cellular, spherical cementumlike psammomatoid calcifications, may permeate cancellous bone, myoid areas giant cells, hemorrhage
Synonyms	1-Cemento-ossifying fibroma 2-Cementifying fibroma 3-Periodontoma	1-Juvenile aggressive ossifiyng fibroma 2-Juvenile ossifying fibroma WHO type 3-Trabecular desoosteoblastoma	1-Cemento-ossifying fibroma 2-Juvenile ossfying fibroma with psammomatoid ossicles 3-Juvenile ossfying fibroma psammous desoosteoblastoma

WHO: World Health Organization

Table 2: Differences in clinical and dermograpic presentations of psammomatoid juvenile ossifying fibroma and trabecular juvenile ossifying fibroma (adapted and modified from)[15]

Type	*Site*	*Age*	*Mean age*	*Gender*	*Histopathology*
Psammomatoid juvenile ossifying fibroma	More common in sinonasal and orbital bone	3 months 72 years	16–33 years	M>F More common 1.2:1	Small uniform spherical ossicles resembling psammona bodies
Trabecular juvenile ossifying fibroma	Maxilla > mandible In mandible, body > ramus	2–12 years	8 1/2–12 years	M>F less common	Trabeculae of fibrillar osteoid and woven bone

and juvenile aggressive psammomatoid fibroma, the features of the present case can be diagnosed as juvenile aggressive trabecular ossifying fibroma.

According to the clinical features given by the El Mofty (Table 2),[15] which states that a predominance of maxilla for trabecular pattern does not hold good in our case as it is in the mandible. Further, the Table mentions about a predominance for body of mandible as compared with ramus. Age does not coincide with our case, as it was detected late but was initiated early. Histopathologically, findings of the biopsy coincide with both Tables 1 and 2.[15]

CONCLUSION

Although JOF is an uncommon clinical entity, its aggressive local behavior and high recurrence rate means that it is important to make an early diagnosis, to apply the appropriate treatment, and follow-up the patient over the long term. It is also important to evaluate the radiographs and correlate with its clinical findings and confirm with histopathology, as there are limited cases of this entity reported so far.

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CASE REPORT

Esthetic Rehabilitation of a Fractured Permanent Maxillary Central Incisor by Reattachment

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ABSTRACT

Crown fractures of the anterior teeth are a common form of dental trauma mainly affecting children and adolescents. One of the options for managing crown fractures is the reattachment of the fractured fragment when the tooth fragment is available with minimal or no violation of the biological width. Reattachment of fractured fragments can provide good esthetics, as it maintains the tooth's original anatomic form, color, and surface texture. It also restores function and is a relatively simple procedure. This case report deals with the esthetic management of a crown-root fracture that was successfully treated with endodontic treatment followed by reattachment of fractured fragment with fiber post.

Keywords: Coronal fracture, Dental trauma, Fiber post, Reattachment.

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INTRODUCTION

Traumatic tooth fractures are the common reason for seeking dental care. Most dental injuries occur between 2 and 3 years and between 8 and 12 years of age being more common in boys than in girls because boys are actively involved in extracurricular activities.[1,2] The most frequent causes of trauma are falls; bicycle, motorcycle, and car accidents; sports activities; collision with other people and objects; and domestic violence fights and physical assault.[3,4]

Coronal fractures of permanent incisors represent 18 to 22% of all trauma to dental hard tissues, 28 to 44% being simple (enamel and dentin), and 11 to 15% complex (enamel, dentin, and pulp). Of these, 96% involve maxillary central incisors.[5] Chosack and Eildeman published the first case report on reattachment of a fractured incisor fragment in 1964.[6] Tennery[7] was the first to report the reattachment of a fractured fragment using acid-etch technique. Subsequently, Simonsen[8] has reported similar cases.

Reattachment of tooth fragments should be the first choice and is a viable alternative to conventional approach with minimal or without violation of biologic width because of simplicity, natural esthetics, and conservation of tooth structure. This case report deals with the management of a fractured permanent maxillary central incisor by coronal fragment reattachment using a fiber post.

CASE REPORT

A 28-year-old male patient reported to the Department of Conservative Dentistry and Endodontics with a history of fall and injury to the upper front teeth 2 days prior. Patient was symptomatic. Medical history was not contributory.

Clinical examination (Fig. 1) revealed horizontal fracture with the right maxillary central incisor (11) involving enamel, dentin, and pulp extending labiopalatally. The fractured fragment was loosely attached on the palatal aspect to the tooth. Extraoral examination revealed no significant abnormalities. Soft tissue examination revealed laceration of the upper lip. Tooth was tender on percussion and palpation. Periodontal probing depths were within the normal parameters. The tooth was grade I mobile and gave an early response to vitality tests.

An intraoral periapical radiograph (Fig. 2) showed a thin horizontal radiolucent line approximately at Cementoenamel junction (CEJ). The case was diagnosed

Fig. 1: Complicated crown-root fracture with the right maxillary central incisor

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Fig. 2: Intraoral periapical radiograph showing a thin horizontal radiolucent line approximately at CEJ

Fig. 3: Fractured segment preserved in saline solution to prevent dehydration and discoloration

as symptomatic irreversible pulpitis secondary to complicated crown root fracture (N502.54, as per WHO classification) with symptomatic apical periodontitis. The patient expressed the desire to maintain the tooth and restore it, as it was economical compared with a fixed partial prosthesis. A detailed explanation about the treatment plan was given to the patient, which included completion of endodontic treatment followed by reattachment of the fractured fragment using a fiber post. An informed consent was taken from the patient.

MANAGEMENT

Removal of fractured fragment: In the first visit, local anesthesia (2%) with adrenaline (1:200,000) (Neon Laboratories Ltd, Mumbai, Maharashtra, India) was administered and the fractured fragment was completely removed atraumatically by gently holding the crown of the involved tooth with an extraction forceps. Hemorrhage was controlled and the fractured segment was preserved in physiological saline solution (Fresenius Kabi AG, Bad Homburg vor der Höhe, Germany) (Fig. 3).

Treatment of the fractured fragment: The fit of the fragment was checked; it was observed that there was some hindrance in the approximation palatally; so, after completion of root canal treatment and before trial of post, surgical reflection of palatal flap was planned. A two-stage procedure was decided upon which included completion of endodontic treatment in the first visit and raising of palatal flap and fragment reattachment in the second visit.

The coronal portion of the fractured fragment was immersed in 5% sodium hypochlorite for half an hour and a #20 broach (Mani, INC, Utsunomiya, Tochigi, Japan) was used for complete debridement of pulp tissue in the pulp chamber. The fragment was rinsed with 0.9% normal saline to remove residual sodium hypochlorite and preserved in normal saline till the end of the procedure. A housing (Fig. 4) was also prepared in the pulp chamber of the fractured crown fragment with a long tapered fissure bur (Mani, Inc, Japan) for receiving the coronal portion of the fiber post.

Treatment of remaining tooth structure: The root canal was debrided using a #20 broach (Mani, Inc, Japan). Tentative working length was established using an Electronic Apex Locator, Raypex 5 (VDW, München, Germany) and the corrected working length was confirmed by radiograph. Biomechanical preparation was done by a step-back technique. The master apical file (MAF) was 40 K-file (Mani, Inc, Japan). A concentration of 5% sodium hypochlorite and saline (Fresenius Kabi AG, Bad Homburg vor der Höhe, Germany) solution were used as irrigants during the preparation alternately.

The root canal was dried with absorbent points (Sure Endo, Gyeonggi-do, Korea) and obturated using lateral

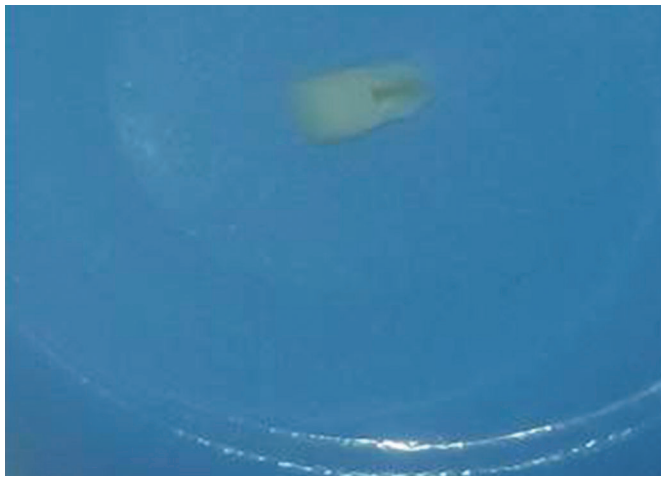
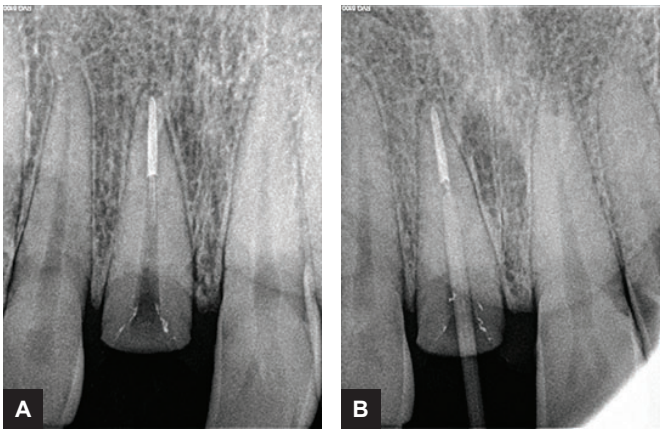


Fig. 4: A housing prepared in the pulp chamber of the fractured crown fragment for receiving the coronal portion of the post



Figs 5A and B: (A) Post space preparation and (B) fiber post

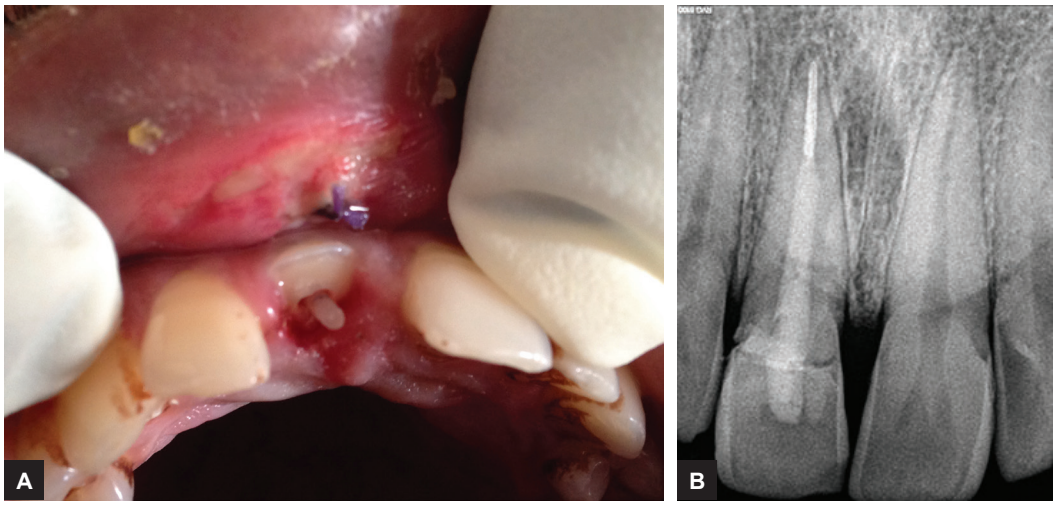
compaction technique with gutta percha (Dentsply Maillefer, Ballaigues, Switzerland) and AH plus sealer (Dentsply, India Pvt. Ltd, Delhi, India). After completion of the obturation, the root canal was prepared for the post placement (Fig. 5A) by removing the gutta-percha from the coronal two-thirds of the canal with heated instruments and postspace was prepared by peeso reamers (size 2, 3) (Mani, Inc, Japan). An appropriate size fiber post (Luminex, Dentatus AB, Sweden) was selected, and alignment of the coronal fragment was verified clinically and radiographically with the post in place (Fig. 5B). The tooth was temporized and patient was recalled the next day.

In the second visit, local anesthesia was administered to the patient and a palatal flap (Fig. 6A) was raised by giving a crevicular incision extending from mesial aspect of 12 to mesial aspect of 21 and the alignment of the coronal fragment was verified radiographically with the post in place. Once the post trial was done, the root canal was dried with absorbent points; glass ionomer luting cement (Fuji I, GC, Japan) was placed in the canal with the help of an appropriate size of K-file and was also applied to the inner side of the housing of the fractured fragment. The fiber post was also coated with the luting cement and along with the coronal segment was cemented in the root canal as one unit (Fig. 6B). The excess cement was removed. Once the cement had set, the flap was sutured in place and a radiograph was taken.

After cementation, the reattachment line was visible labially; thus to mask it, vertical grooves were prepared that would serve as retention locks for the composite resin. A shade A2 was selected as appropriate with the help of VITA shade guide. The area was then etched using 37% phosphoric acid for 15 seconds and thoroughly rinsed off. An adhesive (Adper Single Bond 2, 3M ESPE, St. Paul, MN, USA) was applied, cured for 15 seconds following which composite resin (Filtek Z350, 3M ESPE, St. Paul, MN, USA) was placed in increments and cured respectively. Finishing and polishing (Sof-Lex disks 3M ESPE, St. Paul, MN, USA) of the composite was done and the occlusion was checked (Fig. 7). Patient was given postoperative instructions and advised not to bite or eat with his front tooth. Patient was recalled after 1 week for removal of sutures and final polishing of composite resin restoration.

DISCUSSION

Coronal fractures must be approached in a methodical and clinically indicated manner to achieve a successful restoration. There are several treatment options for the treatment of tooth fractures involving the biologic width, such as tooth extrusion, crown lengthening followed by fragment reattachment or reconstruction, intentional reimplantation, and even tooth extraction in severe cases.[9] Several conditions must be taken into consideration to determine the ideal option, such as the location and extent of the fracture, the pulpal condition, the degree of tooth eruption, the degree of root formation, and the patient's esthetic demand.[10]



Figs 6A and B: (A) Palatal flap with crevicular incision and (B) fracture fragment reattached with fiber post cemented

Fig. 7: Fragment reattachment with 11

One of the options for managing coronal tooth fractures, especially when there is no or minimal violation of the biological width, is the reattachment of fractured fragment when it is available.[11] Reattachment of a fragment can provide good esthetics that can be obtained in a single appointment, as this procedure is relatively simple, atraumatic, and inexpensive.[12] With the fracture line extending below the alveolar crestal bone, orthodontic extrusion or surgical extrusion is recommended before the restoration. But with the fracture lying above the alveolar bone crest, reattachment of the fractured fragment is a more viable option. In the present case report, the fracture line seemed to be obliquely running labiopalatally extending below the gingival contour palatally but above the bone crest. Hence, a conservative approach was planned and it was decided to reattach the fractured fragment by fiber post. Hence, for good visualization of the fractured fragment and also to remove the luting cement flash, a palatal flap was raised.

Discoloration and dehydration of the fragment may occur due to longer extraoral time, so in the present case, the fragment was preserved in saline throughout the procedure. In case of complicated fractures when endodontic therapy is required, the space provided by the pulp chamber can be used as an inner reinforcement thus avoiding further preparation of fractured tooth.[13] The use of post increases retention and distributes the stress along the root; with the help of the glass fiber post, the fractured crown can be permanently bonded to the root[14] providing a monoblock effect. Tooth-colored fiber posts have several advantages. They are more esthetic, can be bonded to tooth structure, modulus of elasticity is similar to that of dentin, and hence less chances of fracture.[12] Metal posts are rigid and may cause fracture during tooth movement. In this case, fiber post was used to reinforce the pulp less tooth. Its monoblock effect with no inherent weak interlayer interface helps in distribution of stresses to the remaining radicular dentin; there is less chance of microleakage and good bond strength to tooth.

The remarkable advancement of adhesive systems and resin composites has made reattachment of tooth fragments a procedure that is no longer a provisional restoration, but rather a restorative treatment offering a favorable prognosis. However, this technique can be used only when the intact tooth fragment is available.[8] Although the fractured fragment could be well aligned with the apical fragment, the reattachment line was visible. To mask this line labially and to reinforce the fragments, vertical slots were made across the fractured fragment to aid as retention locks and restored with composite resin to provide a more esthetic appearance.

CONCLUSION

Tooth fragment reattachment procedure offers conservative, cost-effective, safe, fast, and esthetically pleasing results when the fragment is available. Progress in adhesive technology and composite resin materials allows not only for the creation of esthetic restorations but also for the preservation and reinforcement of tooth structure.

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CASE REPORT

Management of a Traumatized Open Apex Tooth with a Combination of Mineral Trioxide Aggregate Apical Plug and Platelet-rich Fibrin Apical Matrix

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ABSTRACT

The absence of a natural apical constriction in permanent tooth makes endodontic treatment a challenge. Traditionally, calcium hydroxide was used for inducing the formation of an apical barrier. Currently, mineral trioxide aggregate (MTA) has shown promising results for apexification procedures. In an open apex, it is imperative to limit the MTA placement within the confines of the root canal for predictable healing. The placement of an internal matrix may limit the extrusion to some extent. Many materials can be used as internal matrix such as collagen membrane, calcium sulphate, hydroxyapatite, freeze dried bone, and platelet-rich fibrin (PRF) among others. This case report presents a successful demonstration of the management of an open apex using MTA placed over an internal apical matrix of PRF.

Keywords: Apexification, Mineral trioxide aggregate, Open apex, Platelet-rich fibrin.

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INTRODUCTION

Traumatic injuries to teeth in young children may lead to pulp necrosis and root development may cease subsequently resulting in the formation of an open apex. An open apex may also result from extensive resorption of a mature apex following orthodontic treatment, or due to periradicular inflammation.[1] Teeth with open apex are a challenge to manage owing to the difficulties in debriding, disinfecting, and predictable sealing of the root canal space. As the apex is not completely formed, no barrier, exists to stop the obturating material from moving into and traumatizing the apical periodontal tissues. Thin dentinal walls are susceptible to fracture both during and after treatment. These problems are overcome by stimulating the formation of a hard tissue barrier to allow for optimal filling of the canal and reinforcing the weakened root against fracture both during and after apexification. The process of creating a hard tissue barrier at an open apex or at a grossly over-instrumented apex is termed as apexification. Calcium hydroxide (CH) has been the material of choice for inducing formation of hard tissue barrier.[2] Calcific barrier formation is induced with repeated changes of material over the course of 5 to 20 months[3] averaging 12.9 months.[4] Disadvantages of this technique are its prolonged treatment time, the need for multiple visits, reduced fracture resistance with prolonged use of CH, radiographs, the loss of coronal restoration making the tooth susceptible to reinfection, and patient complaints. Mineral trioxide aggregate (MTA) has been used as an alternative to CH apexification to seal the open apex.[5] The favorable properties of MTA include biocompatibility, good sealing ability, and promote periradicular tissue regeneration.[6]

In wide open apex, it is difficult to place MTA and confine it within the canal. The placement of an apical matrix will limit the MTA within the confines of the root canal space; furthermore, it will aide in obtaining a well compacted apical plug. Lemon[7] developed the internal matrix concept, in which an intermediate layer of hydroxyapatite was placed through the perforation to form an external barrier and matrix, against which the perforation repair material (amalgam) could be condensed. Bargholz[8] introduced modified matrix concept in which a resorbable collagen was placed as a matrix followed by condensation of MTA, thereby preventing MTA overfill. Several other materials have also been recommended to create a matrix in cases of perforations as well as teeth with incomplete formation of apex, which include CH, hydroxyapatite, resorbable collagen, calcium sulphate, platelet-rich fibrin (PRF), freeze dried bone allograft and tricalcium phosphate.[9-12]

Platelet-rich fibrin developed in France by Choukroun and Dohan represents a new step in the platelet gel therapeutic concept. Platelet-rich fibrin is a matrix of

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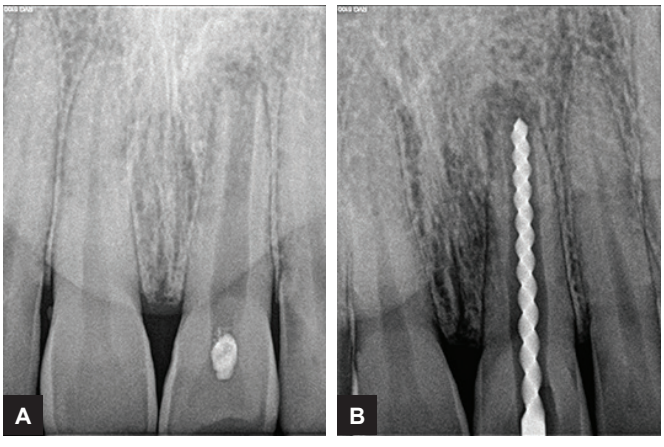
autologous fibrin embedded with a large quantity of platelet and leukocyte cytokines during centrifugation. It is interesting to know that PRF matrix enmeshes glycosaminoglycans from blood and platelet. Glycosaminoglycans have a strong affinity with small circulating peptides and a great capacity to support cell migration and healing processes.[12] The PRF membrane has shown promising apical matrix for MTA. It prevents extrusion of MTA and promotes wound healing.

This case report describes the nonsurgical management of a traumatized maxillary central incisor with a wide open apex by placing MTA in combination with autologous PRF membrane as an apical matrix.

CASE REPORT

A 32-year-old male patient was referred to the Department of Conservative Dentistry and Endodontics with a chief complaint of fractured and discolored maxillary left central incisor (Fig. 1). Patient gave a history of trauma to maxillary left central incisor at the age of 10 years, following which the patient claimed that he had undergone dental treatment for the same. Medical history was noncontributory. Intraoral examination revealed a discolored maxillary left central incisor with temporary restoration in the access cavity. Patient had pain on percussion, periodontal probing within normal limits (<3 mm), and no mobility. Radiographic examination revealed an immature apex associated with a periapical lesion in relation to 21 (Fig. 1). A diagnosis of previously initiated root canal treatment with symptomatic apical periodontitis in relation to 21 was arrived at.

The treatment options given to the patient were nonsurgical endodontic treatment with one-step MTA apexification procedure, endodontic treatment followed by periapical surgery for removal of the lesion and retrofilling, extraction, and single tooth implant or fixed partial denture. Considering the age of the patient and the surgical trauma that could occur, it was decided to opt for nonsurgical root canal treatment. The tooth was isolated under rubber dam, temporary restoration was removed, and endodontic access cavity was modified. The root canal was explored with a #25 K-file (Mani, Tamil Nadu, India). The canal was patent, wide, and the largest file to bind to apical extent of the canal was #120 K-file. An intraoral periapical radiograph (IOPA) was taken to determine the working length (Fig. 1B). The root canal was gently, circumferentially filed with #120 K-file. The canal was irrigated intermittently with 2.5% sodium hypochlorite (NaOCl) (Prime Dental Products Pvt Ltd., Maharashtra, India). Finally, passive ultrasonic irrigation was carried with ultrasonic #25K-file (Satellac Acteon Group, New Delhi, India) at a setting of 4.0 for 1 minute with NaOCl as irrigant. The root canal was then dried with sterile absorbent points (Sure endo; SureDent Co. Ltd., Gyeonggi-do, Korea). A thick paste of CH (Deepashree Products, Ratnagiri, India) mixed with saline was placed in the root canal (Fig. 2), and the patient was recalled after 2 weeks. At 2-week recall appointment, CH was removed using H-files (Mani, Tamil Nadu, India) and passive ultrasonic irrigation. The root canal was then dried with sterile absorbent points.



Figs 1A and B: (A) Preoperative radiograph showing 21 with access cavity restoration associated with an open apex and periapical radiolucency, (B) Working length radiograph

Fig. 2: Intraoral periapical radiograph showing dense calcium hydroxide medication placed in 21

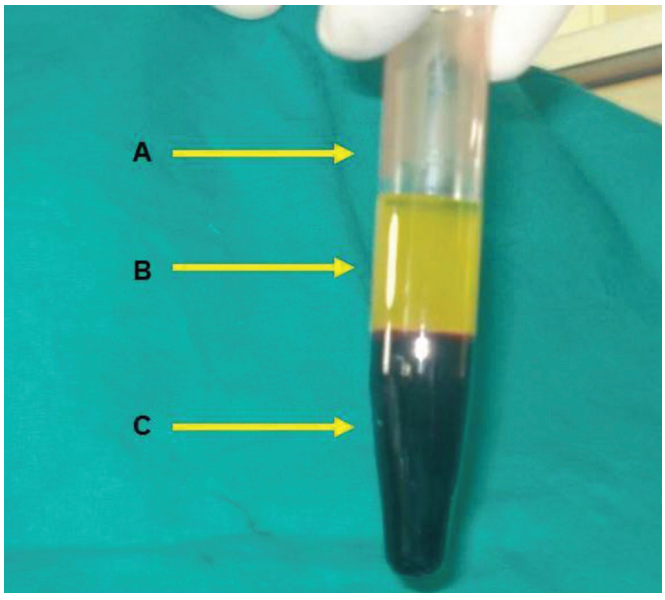


Fig. 3: Centrifuged blood showing three layers: A: Top—platelet-poor plasma; B: Middle—PRF; C: bottom layer containing RBCs

It was decided to use PRF membrane as an internal matrix at the apical foramen prior to MTA placement. 10 ml of patient's venous blood was drawn by venipuncture from the anticubital vein, and was collected in 10ml test tube without anticoagulant and immediately centrifuged (Process® centrifuge PC-02; Process Ltd., Nice, France) at 3000 rpm for 15 minutes.[13] The centrifugation product consisted of three layers (Fig. 3): A base of red blood corpuscles (RBCs) at the bottom, acellular plasma on the surface, and PRF clot in the middle. The fibrin clot was separated from the lower most layer of the centrifugation product. The PRF clot was gently pressed into a membrane form with a sterile moist gauze (Fig. 4) and placed on a sterile glass slab. The required quantity of PRF membrane was introduced into the canal and positioned apically with a hand plugger (GDC, Punjab, India) at the apical foramen and into the bony space beyond it. White Proroot MTA (Dentsply, Ballaigues, Switzerland) was mixed with sterile water as per manufacturer instructions and placed in the apical third using hand pluggers and compacted with absorbent points. It was further compacted using indirect ultrasonics. Thus, 5 mm of MTA apical plug was obtained, and a radiograph was taken to confirm the placement of dense MTA apical plug (Fig. 5). A moistened pellet of cotton was placed in the canal and access cavity was sealed with Cavit (3M ESPE, Seefeld, Germany).

Patient was recalled after 2 days and was completely asymptomatic. Temporary restoration was removed and the set of MTA was confirmed. The canal was irrigated with 2.5% NaOCl followed by saline, dried, and a prefabricated fiber post (Luminex; Dentatus AB, Stockholm, Sweden) was cemented using Paracore (Coltene/whaldent Inc. Cuyahoga Falls, OH, USA) (Fig. 6). Further, the tooth was restored with porcelain fused to metal (PFM) crown. The patient was recalled after 3 months (Fig. 7). At 9 months of follow-up, the patient was asymptomatic and periapical radiograph demonstrated satisfactory healing (Fig. 8).

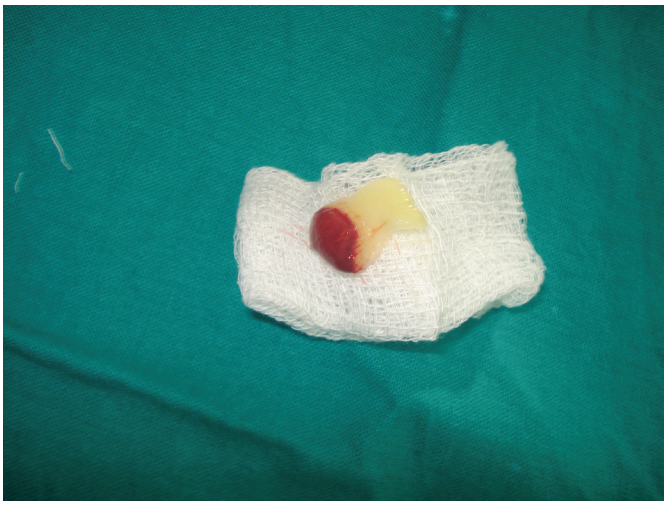


Fig. 4: Platelet-rich fibrin membrane in gauze

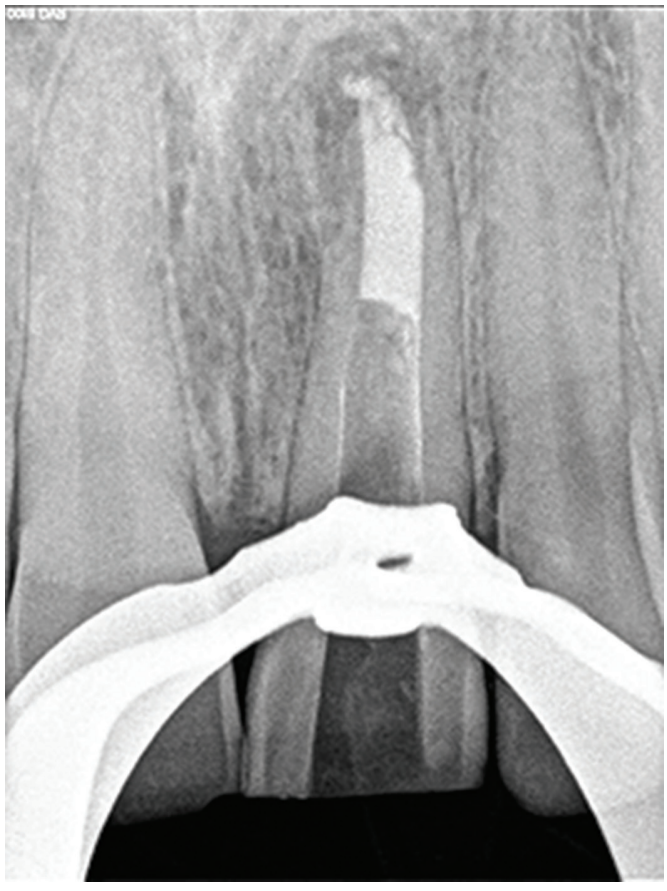


Fig. 5: Mineral trioxide aggregate apical plug

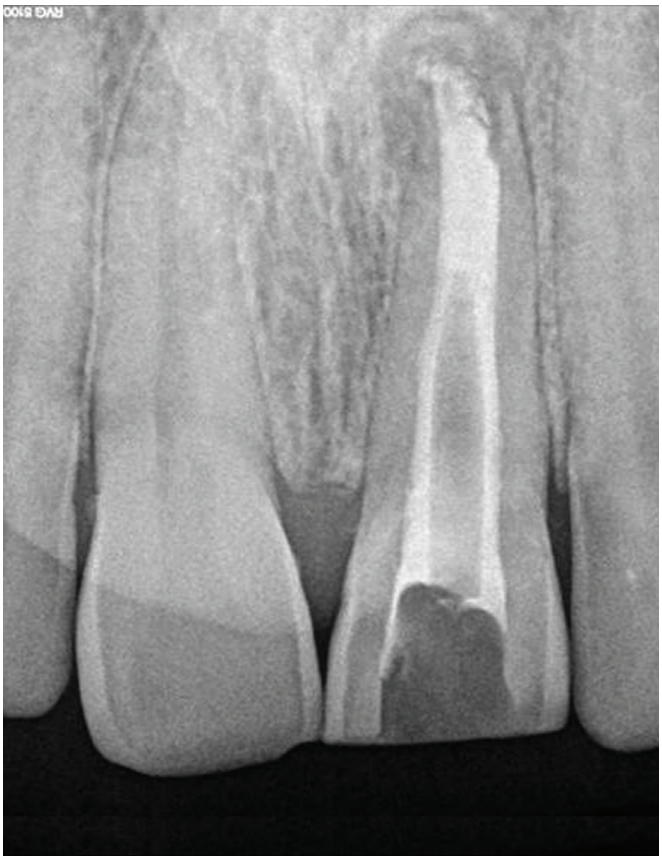


Fig. 6: Fiber post luted with paracore

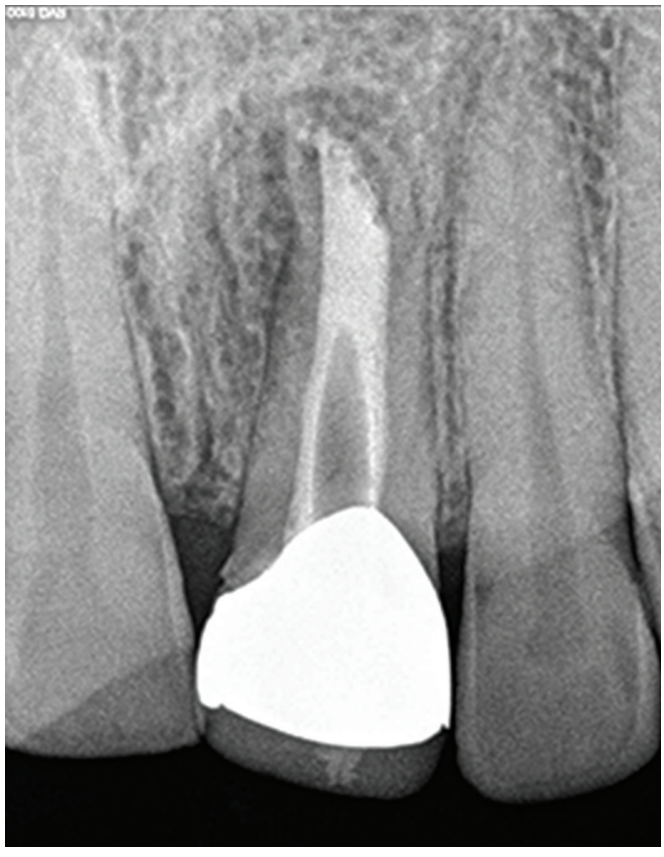


Fig. 7: Three-month radiograph

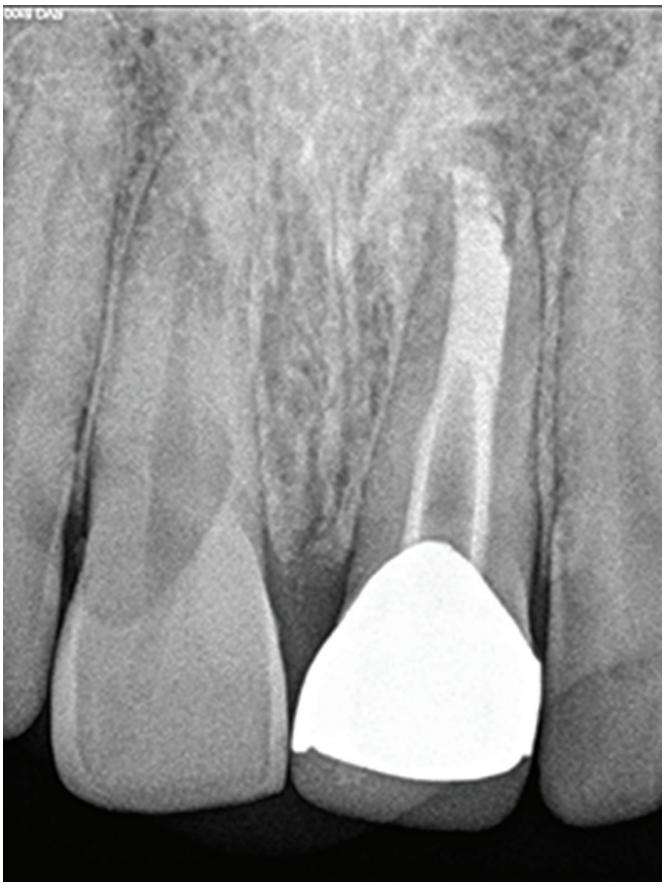


Fig. 8: Nine-month radiograph showing satisfactory healing

DISCUSSION

Root-end closure previously referred to as apexification is the induction of an artificial calcified barrier across the open apex. An immature root has a considerably wide apical opening that may be apically diverging or parallel with thin canal walls. The factors essential for success are thorough debridement and disinfection of the root canal space. The presence of fragile radicular walls precludes optimal filing as carried out in teeth with mature apices. Hence, disinfection of the root canal system relies mainly on the action of irrigants and intracanal medications. Passive ultrasonic irrigation was done in the canal space, as it is more effective than conventional syringe irrigation at eliminating debris, bacteria, and pulp tissue in the isthmuses, lateral and apical ramifications, and flattened areas.[1,14] In the present case, CH paste was placed to disinfect the canal that would create an environment conducive for the formation of an apical barrier.[15]

Different materials have been used for root-end closure and the most promising being MTA. Due to its noncytotoxicity, MTA has good biological properties and stimulates repair.[15] The major problem in cases of a wide open apex is confining MTA to the canal space while obtaining a void-free apical plug during compaction, thereby avoiding the extrusion of a large amount of MTA

into the periapical tissue. All types of MTA material contain arsenic that might leach out into the periapical tissues. Although the quantity released is insignificant it can potentially cause toxicity, which has been a cause of concern.[16] Moreover, a large volume of extruded material may set before it disintegrates and gets resorbed. This might result in persistent inflammatory process, which may complicate or even prevent the repair of the tissue.[17] Hence the internal matrix is placed to prevent extrusion of the material. Extent of periapical bone loss significantly influences the clinical decision for the need and also type of internal matrix. Moreover, the type of internal matrix to be placed also depends on the apical foramen diameter and facilitates the placement of a dense apical plug thereby allowing a favorable healing of the periodontal tissues.

Various materials have been reported to be used as an internal apical barrier in combination with MTA.[18] The currently introduced technique of using PRF membrane was considered as an apical matrix. Platelet-rich fibrin is an autologous fibrin gel with cicatricial properties; it is a new platelet concentrate, which has advantages of low cost, ease of procedure, does not dissolve quickly after application, and is biocompatible. The success of this technique depends entirely on the speed of blood collection and transfer to the centrifuge, if prolonged failure will occur. A large quantity of platelets and leukocyte cytokines are embedded during centrifugation.[12] The intrinsic incorporation of cytokines within the fibrin mesh allows for their progressive release over time (7–10 days), as the network of fibrin disintegrates. The use of this platelet and immune concentrate offers the following advantages.[19] First, the fibrin clot plays an important mechanical role, with the PRF membrane maintaining and protecting the grafted biomaterials and PRF fragments serving as biological connectors between bone particles. Second, the integration of this fibrin network into the regenerative site facilitates cellular migration, particularly for endothelial cells necessary for the neoangiogenesis,[20] vascularization, and survival of the graft. Third, the platelet cytokines (platelet-derived growth factor, transforming growth factor, insulin-like growth factor-1) are gradually released as the fibrin matrix is resorbed, thus creating a perpetual process of healing. Lastly, the presence of leukocytes and cytokines in the fibrin network can play a significant role in the self-regulation of inflammatory and infectious phenomena within the grafted material.

Although one-step MTA apexification provides several advantages, the canal wall remains thin, weak, and susceptible to fracture. A fiber post was cemented with dual cure composite resin. Studies have suggested that the fiber posts significantly reinforce the cervical area of the teeth and decrease catastrophic fracture. This might be related to a similar modulus of elasticity of fiber post and dentin. Also, fiber post might evenly distribute forces along the root.[21]

CONCLUSION

This case report demonstrates that teeth with wide open apices can be treated successfully with nonsurgical treatment using PRF as internal apical matrix under MTA apical plug for one-step apexification procedure. Further long-term randomized clinical trial need to be conducted to evaluate the successful outcomes.

CLINICAL SIGNIFICANCE

In teeth with immature apex, a biodegradable, autologous material such as PRF membrane can be placed as barrier prior to compacting MTA in the apical third of the root canal. This will aid in the prevention of extrusion of MTA and enhance the healing potential.

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CASE REPORT

Clinical Experience with Osteosynthesis of Subcondylar Fractures of the Mandible using Delta Plate

[1]Shailesh Nareshkumar Kokal, [2]Suraj Arjun Ahuja, [3]Nareshkumar T Kokal, [4]Haemant A Baonerkar

ABSTRACT

Mandibular condyle fractures are one of the most frequent injuries of the facial skeleton. The option for open treatment of mandibular condyle fractures has become more favorable since osteosynthesis materials were developed in the past few decades. However, the rigid fixation techniques of treating condyle fractures remain one of the controversial issues in maxillofacial trauma. Several techniques and plate types such as adaption miniplates, minidynamic compression plates, resorbable plates, and double plates have been evaluated biomechanically in various experimental and clinical studies. The present case report is to evaluate the clinical use of indigenously developed titanium delta-shaped miniplate in open reduction and internal fixation of subcondylar fracture.

Keywords: Delta plate, Osteosynthesis of condyle, Subcondylar fracture.

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INTRODUCTION

Fractures of the condylar region are frequent, with clinical studies reporting 25 to 45% of all mandibular fractures.[1,2] Open reduction and rigid internal fixation (ORIF) of condylar base and neck fractures has become the surgical standard. The debate continues over how to best manage subcondylar fractures and the question of which fractures should be treated surgically has yet to be answered. However, in recent years, due to the enormous development of the osteosynthesis technique and the refinement of surgical techniques, the attitude toward the treatment of a condylar neck fracture has changed from an exclusively nonsurgical approach toward surgical treatment. To reach the condyle area, different approaches are used, for example, the transoral approach or different extraoral approaches such as the periangular, preauricular, retromandibular, transparotid and retroauricular.[3-6] The goals of ORIF in condyle fracture management are to restore function, re-establish premorbid anatomy, and provide fracture stability. The latter can be achieved by different fixation techniques. Two miniplates (double-plate technique) are the most reliable because these neutralize tension and pressure forces best and produce greater stability.[7,8] Their application may require an extraoral surgical approach, with disadvantages such as risk of facial nerve injury and visible scarring. The intraoral approach with endoscopic control offers an alternative; however, because of the limited space, two miniplates may be difficult to apply.[9,10]

As an alternative to the modified two-miniplate technique, specially designed plates such as the Delta plate are available, and biomechanical and clinical studies have confirmed that these plates allow for sufficient neutralization of strains. Therefore, these plates provide sufficient stabilization for ORIF of subcondylar and condylar neck fractures combined with the advantage of a smaller plate.[11-13]

The present case report is to evaluate the clinical use of indigenously developed titanium delta-shaped miniplate in open reduction and internal fixation of subcondylar fracture.

CASE REPORT

A 24-year-old female reported with a complaint of swelling and pain with left side of the face since 1 day with a history of road traffic accident 1 day back. Her general health conditions were good, but she referred pain in the left temporomandibular joint (TMJ) region. The extraoral evaluation revealed asymmetry of the face, with deviation of the chin toward the left side, bruises present with right side of the chin, wherein the traumatic impact occurred. The TMJ evaluation showed functional reduction in mouth opening (16 mm between the edges of the upper and lower incisors), with deviation of the midline toward the left, with restricted TMJ movements. On palpation,

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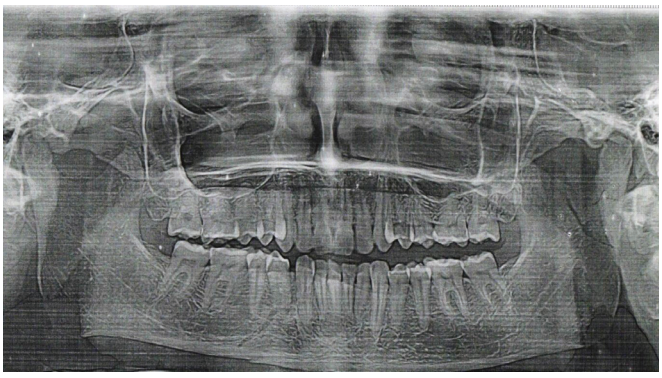
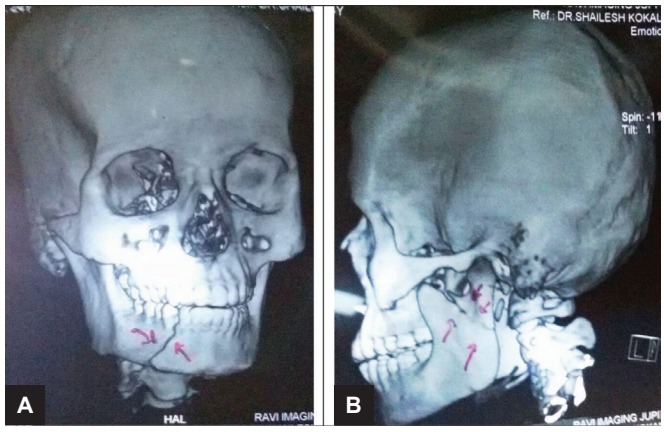


Fig. 1: Orthopantomography showing right mandibular parasymphysis fracture and left mandibular suncondylar fracture



Figs 2A and B: Three-dimensional reconstruction of CT face fracture lines marked by arrows

step deformity was present along the inferior border of the mandible in the right parasymphysis region and tenderness elicited on palpation of left TMJ. The oral evaluation revealed a malocclusion: The lower midline was deviated toward the left, with ipsilateral crossbite and contralateral open bite.

The radiological evaluation panoramic radiograph (Fig. 1) and computed tomography (CT) scans (Figs 2A and B) were done and depicted right mandibular parasymphysis fracture with left mandibular subcondylar fracture. After confirming the diagnosis, open reduction and internal fixation was planned.

General anesthesia was administered through nasotracheal intubation. Transparotid approach was used for fracture reduction of the condyle. The skin is incised; the subcutaneous tissues are dissected superficial to the superficial muscular aponeurotic system in an anterosuperior direction using blunt and sharp dissection until masseter muscle fibers appear. Facial nerve fibers are not always visible, but should be preserved carefully and protected with a retractor when they are detected. The deeper muscle fibers lying underneath the facial nerve can be transected safely if necessary. The pterygomasseteric sling that is divided along with the periosteum and the fracture is identified and reduced. Once the fracture is reduced, rigid plate osteosyntheses are performed using delta plate (Fig. 3). Double-layered closure is done and hemostasis is achieved. Parasymphysis fracture was accessed via intaoral circumvestibular incision and ORIF was done with two 2 mm four-hole plates (Fig. 4). A postoperative OPG was taken to confirm the position of the condyle and stability of fixation (Fig. 5).[11] Postoperative

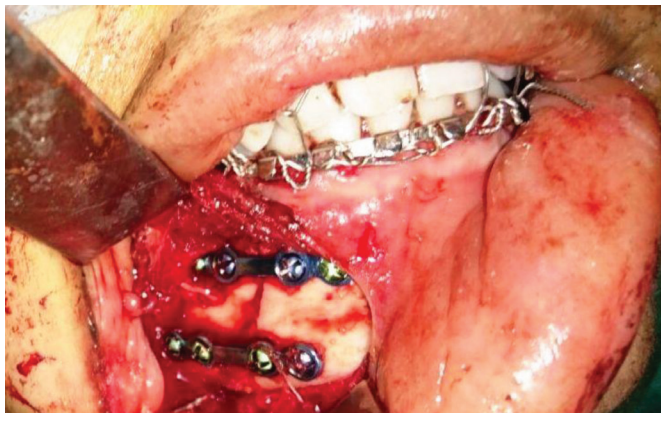


Fig. 4: Parasymphysis fracture accessed via intaoral circumvestibular incision and ORIF done with two 2 mm four-hole plates

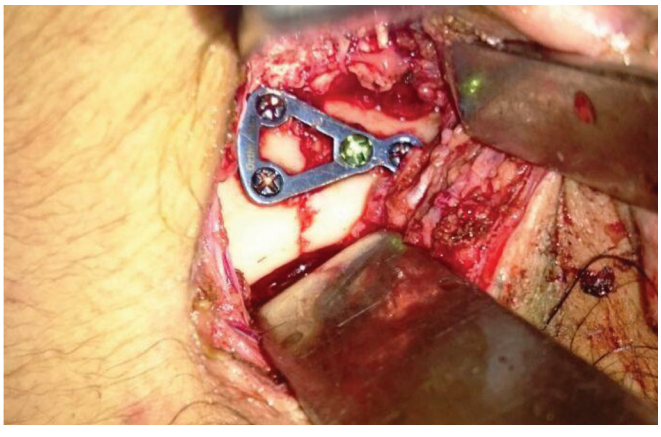


Fig. 3: Subcondylar fracture is reduced and rigid fixation done using delta plate

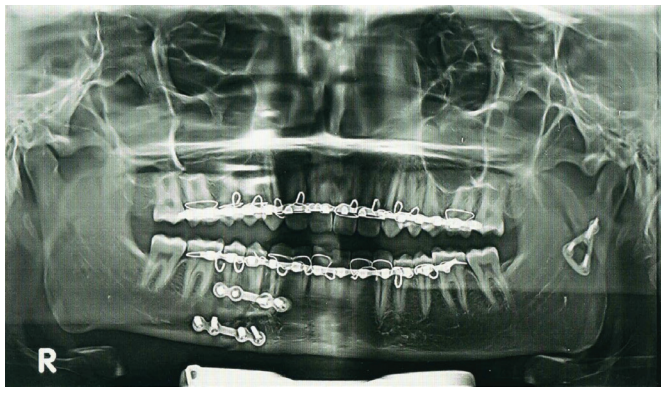


Fig. 5: A postoperative orthopantomography showing fixation of right mandibular parasymphysis fracture with mini plates and that of left mandibular suncondylar fracture by delta Plate

mouth opening was 38 mm and satisfactory occlusion was achieved and thus no intermaxillary fixation was required. Patient was followed up for 6 months and no complications such as facial nerve palsy, plate bending, plate fracture, screw loosing were encountered.

DISCUSSION

The method of fixing the condylar fracture is either by open reduction or by closed reduction, which has always evoked controversies. Although many systems of rigid fixation have been described, the one with miniplates is the preferred technique today. The three-dimensional (3D) osteosynthesis plates were introduced into maxillofacial surgery in the early 1990s. Advantages are the smaller size combined with greater stiffness of the plates. As an alternative to the modified two-miniplate technique, specially designed plates such as the delta plate or the trapezoid plate are available, and biomechanical and clinical studies have confirmed that these plates allow for sufficient neutralization of strains. Therefore, these plates provide sufficient stabilization for open reduction and internal fixation of subcondylar and condylar neck fractures combined with the advantage of a smaller plate.[14] The design of the new delta-shaped miniplate takes into account previous *in vitro* analysis on load, strain, and bone deformation at the condylar neck region, as well as finite-element analysis. Tensile strains occur mainly at the anterior and lateral borders of the condyle, and compressive strains at the posterior and medial borders.[8,15,16] Due to the permanent mediolateral bending of the condyle during function, a certain stiffness of the plate, a stronger plate, or two plates are recommended.[17,18] The two plates are usually placed along the tensile stress lines. In the delta-shaped plate, the base is oriented toward the angle of the mandible; thus, the lines of tensile and compressive stress distribution run parallel to both sides of the plate. The plate is 1 mm thick, 20 mm long, and 5 mm wide at the top and 12 mm wide at the base. At the top of the plate is an arm with two longitudinally arranged holes; two more holes form the two corners of the base of the plate.[11] Using the new delta-shaped plate for condylar neck fractures has three main advantages: (1) neutralization of changing strains at the anterior, lateral, and posterior borders; (2) the additional stabilization provided by a compression miniplate; and (3) a small osteosynthesis plate.[11] Delta plating system can transmit the demanded loads in all directions of movement. This plate allows a functionally stable osteosynthesis in the condylar neck region of the mandible and that this type of osteosynthesis can resist physiologic strains in the injured (TMJ) as described by Lauer et al.[11]

The condyle is subject to forces in five different directions: Posterior to anterior, anterior to posterior, medial to lateral, lateral to medial, and torsion. Under these conditions, the 3D nature of the plate due to its triangular shape provides internal stability, as well as more optimal leverage. To counteract posterior or anterior loads onto the proximal fragment, the base of the plate is safely fastened in the distal fragment with two screws set apart at a distance to provide optimal leverage. Furthermore, the sides of the triangle act alternately as a tension band depending on load direction. Against torsion forces, the plate is more resistant because the two sides of the triangle and the anchoring screws have a distance in the horizontal; consequently, lower loads are transmitted into the bone due to better leverage. For medial tilt, tension forces are applied on the plate. No particular thickness of the plate is required if the surfaces of the reduced bone fragments support each other. If there is an interfragmentary gap after osteosynthesis, the thickness of the plate is important, because the plate must withstand bending forces. Independent of reduction result, plate stiffness is also important to resist lateral tilting. A biomechanical model[17] has demonstrated a thickness of less than 1 mm to be insufficient to resist plate bending or fracture.

In summary, the design of the newly developed plate allows for treatment of even high condylar neck fractures. The plate's delta shape can handle changing loads, with the highest tensile strain occurring at the anterior and lateral surfaces and the highest compressive strains on the posterior surface.[8,16-18] The plate can be easily placed in the confined space at the condylar neck by an experienced surgeon.

CONCLUSION

Fixation of subcondylar fracture with delta plate was easy even in the confined space of the condylar neck. Radiographic follow-up after 6 months showed that the osteosynthesis was reliably stable, and the functional results are in accordance with other clinical studies on ORIF of fractures of the condylar neck. The surgical ease, comfortable adaptation, and adequate stability were achieved by these plates. The functional and esthetic outcome with this procedure has proved beyond doubt that this plating system is one of the emerging trends in managing subcondylar fractures. No special armamentarium was required, as only the shape of the plate differs and the screw and screw holes are the same as the routine mini plating system.

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CASE REPORT

Oral Submucous Fibrosis

[1]Ashvin Panditrao Wagh, [2]Jyotsna Galinde

ABSTRACT

The pedicled buccal pad of fat has been widely used for the reconstruction of defect; application of this flap in the treatment of patient suffering from oral submucous fibrosis (OSMF) is reported here. The patient underwent incision of fibrotic bands and coverage of this buccal defect with buccal pad of fat. The surgical technique is described and the results suggest that this is a logical, reliable, and convenient technique for OSMF.

Keywords: Buccal pad of fat, Coronoidectomy, Oral submucous fibrosis.

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INTRODUCTION

It is defined as an insidious, chronic disease that affects any part of the oral cavity and sometimes the pharynx. Although occasionally preceded by, or associated with, formation of vesicles, it is always associated with a juxta epithelial inflammatory reaction followed by fibroelastic change of the lamina propria and epithelial atrophy that leads to stiffness of the oral mucosa and causes trismus and an inability to eat. [1] The most commonly involved site is buccal mucosa, followed by palate, retromolar region, faucial pillars and pharynx.

Epidemiological and *in vitro* experimental studies have shown that chewing areca nut (Areca catechu) is the major etiological factor for oral submucous fibrosis (OSMF). Currently, in India, Pakistan, and Bangladesh, betel quid and gutkha are the most commonly used commercially freeze-dried areca-nut products. Malignant transformation particularly into squamous-cell carcinoma is in the range of 7 to 13%. Generally, younger patients develop clinical features of OSMF within 3.5 years from onset of the habit, while in older patients it takes 6.5 years. Treatment of OSMF is a challenge, as the pathogenesis of the disease is obscure. Consequently, improved oral opening and relief of symptoms form the objective of OSMF treatment.

The aim of this article is to present a case of OSMF treated with bilateral incision of fibrotic bands, coronoidectomy with reconstruction using buccal pad of fat, and postoperative active physiotherapy.

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CASE REPORT

A 31-year-old male patient presented to the Department of Oral and Maxillofacial Surgery, MGM Dental College and Hospital Kamothe, with a chief complaint of reduced mouth opening since 2 months. Burning sensation and progressive reduction in mouth opening was seen over last the 6 months. He was a tobacco chewer, five to six times a day since 2 years. Patient was hospitalized for 15 days 2 months back and had undergone internal fixation for facial fractures. On examination, fibrous bands present bilaterally in buccal mucosa extending anteriorly from corner of mouth to posteriorly in the retromolar region, which were tender on palpation. There was no history of deafness or dysphagia. Maximum interincisal opening was 18 mm (Fig. 1).

During the surgical procedure under general anesthesia, all third molars were extracted. Fibrous band was incised with electrocautery knife. Buccal mucosa was made free of fibrosis. Bilateral coronoidectomy (Figs 2 and 3) was performed through the same incision.

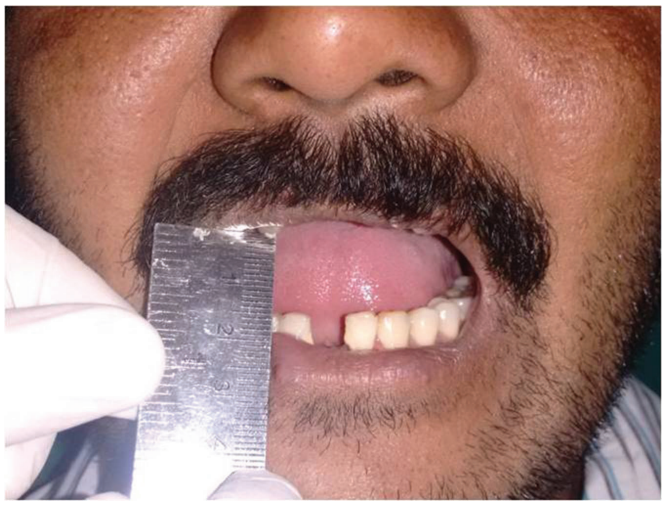

Fig. 1: Preoperative photograph showing maximum mouth opening of 14 mm

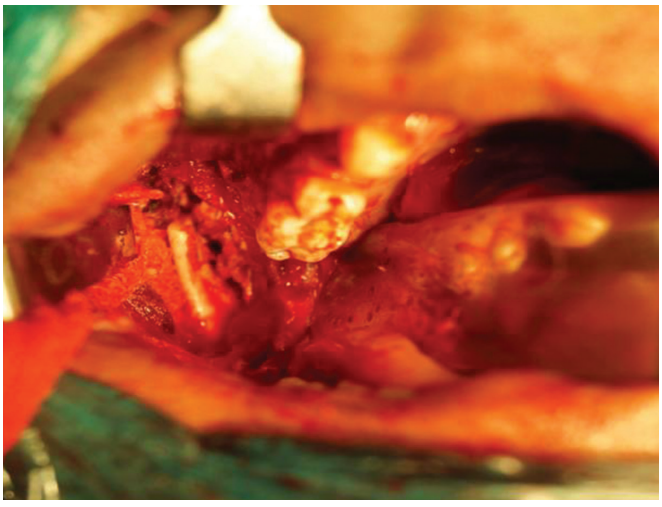

Fig. 2: Intraoperative photograph showing coronoidectomy of right side

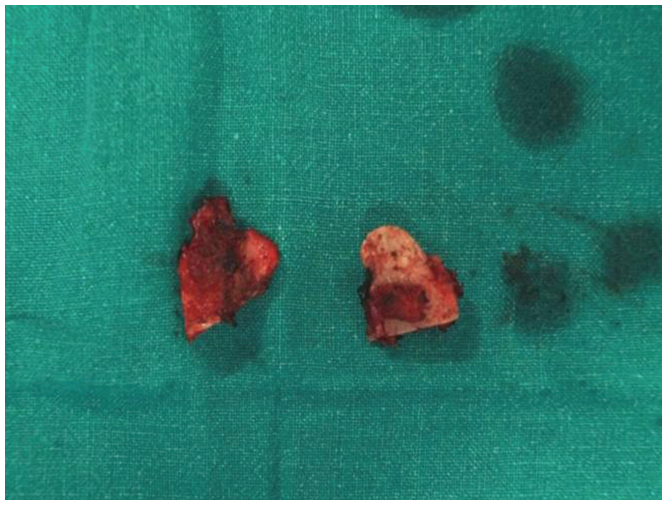

Fig. 3: Right and left coronoid process

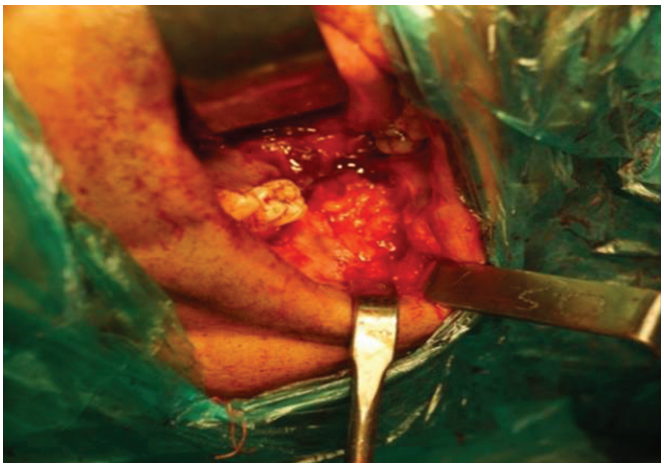

Fig. 4: Intraoperative photograph showing mobilization of buccal pad of fat into the defect

Fig. 5: Intraoperative photograph showing on table mouth opening of 40 mm

Fig. 6: Postoperative photograph showing adequate mouth opening

Buccal fat pad (BFP) was mobilized into the defect (Fig. 4) and the defect was reconstructed. Forty millimeters of mouth opening was achieved intraoperatively (Fig. 5). Patient was kept on ryles tube feeding for 7 postoperative days and was adviced active physiotherapy to maintain adequate mouth opening (Fig. 6).

DISCUSSION

Oral submucous fibrosis is a precancerous condition. At first, OSMF was thought to be idiopathic, but it was later concluded to be multifactorial in origin, and possible etiological factors include capsaicin in chillies, iron, zinc, and deficiencies in essential vitamins. Now the most common etiologic factor in case of OSMF is considered as areca nut-chewing habit; this case gave a history of tobacco chewing since 2 years. Tobacco chewing is considered to have a synergistic role in etiology of the disease, but here it is reflected as a main etiologic factor. Generally, younger patients develop clinical features of

OSMF within 3.5 years from onset of the habit, while in older patients, it takes 6.5 years.[2] Classical features of OSMF, i.e. blanched buccal mucosa with typical marble like appearance and palpable fibrous bands were present. There was restricted mouth opening with the history of burning sensation on consumption of hot and spicy food substances.

The current protocol for the management of OSMF can be divided into three broad groups: Surgical, physical, and medical treatment. Surgical treatment, used mainly to manage trismus, involves incising and releasing the fibrotic areas, and leads to further scarring and fibrosis. The introduction of remote tissue (pedicled, such as a BFP, nasolabial or platysmal flaps, or free tissue transfer) in an attempt to release fibrosis is one approach, but results are variable.

Release of fibrous bands and reconstruction with BFP was chosen as a surgical technique for this case. Scammon was the first to describe the anatomy of the BFP, followed by Goughran. The BFP as an anatomic element was first mentioned by Heister in 1732 and was described by Bichat in 1802.[3] Stuzin et al reported the anatomic findings after the dissection 12 BFPs in six specimens. The average weight of each fat pad was found to be 9.3 gm, and its average volume was 9.6 ml. The BFP has a constant blood supply through the small branches of the facial artery, the internal maxillary artery, and the superficial temporal artery and vein by an abundant net of vascular anastomoses. On average, the volume is 9.6 cc (8.3–11.9 cc). Defects up to 3 × 5 cm can be closed with a BFP alone without compromising the blood supply. The buccal extension and the main body of the fat pad are in close proximity. The main mass of the BFP occupies the buccal space bound medially by the buccinator muscle and laterally by the masseter muscle, and rests on the periosteum that covers the posterior buccal aspect of the maxilla. The transferred BFP starts to epithelialize in a week and completes its epithelialization within 6 weeks. At that time, the graft is covered with healthy-looking oral mucosa. After extraction of all (maxillary and mandibular) third molars, bilateral coronoidectomy was performed. Fibrous bands were incised using electrocautary and reconstruction of the defect was done by mobilizing corresponding BFP in the defect. The BFP was covered with collagen sheet and paraffin bolus dressing was given over it. Ryles tube was secured in order to avoid the contamination of the graft and it was kept *in situ* for about 7 days because the BFP starts to epithelize in a week.

CONCLUSION

Buccal fat pad is a simpler reconstructive technique that is effective, reliable, technically easy, has fewer complications with good results, and worth of consideration. The postoperative physiotherapy and patient compliance plays a vital role in this surgery.

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CASE REPORT

Osteosarcoma of Mandible

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ABSTRACT

Osteosarcomas (OS) are malignant neoplasms of the bone that commonly affect the long bones with rare presentation in jaws. Osteosarcomas of jaws represent about 6 to 8% of all OS, with an incidence of approximately 1 in 1.5 million persons per year. Although the exact cause of OS is still unknown, defects in the retinoblastoma (RB) and p53 genes play an important role in the process. It is characterized histologically by anaplastic stroma with direct osteoid production. Here, we report a case of OS in a 30-year-old female, who came with a massive bony swelling in the right mandibular region.

Keywords: Osteoblastic variant, Osteosarcoma, Sunburst appearance.

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INTRODUCTION

The term 'osteosarcoma', also known as osteogenic sarcoma (OS), refers to a heterogeneous group of primary malignant neoplasms affecting bone forming or mesenchymal tissue that is characterized by formation of osteoid tissue.[1] It occurs most commonly in long bones of extremities near metaphyseal growth plate. Osteogenic sarcoma of jaw is rare and represents only 6 to 8% of all OS. Jaw OS usually presents themselves in the 3rd and 4th decades of life, almost a decade after their presentation in long bone tumors with a slight predilection for the mandible.[2] The exact etiology is unknown. Three main factors generally may play an important role in their development—irradiation, preexisting benign bone disorders, and genetic predisposition. Biologically, OS of the jaw is considered to be less aggressive with a lower incidence of metastasis and hence better prognosis than that occurring in long bones.[3] Despite modern treatment protocols that combine chemotherapy, surgery, and sometimes radiotherapy, the 5-year survival rate for patients diagnosed with OS remains at 50 to 70%.[4,5] Here, we report a case of a 30-year-old female with mandibular bony swelling diagnosed as OS.

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CASE REPORT

A 30-year-old female reported to Department of Oral Pathology and Microbiology, MGM Dental College and Hospital, Navi Mumbai, with a chief complain of swelling in lower right back region since 8 months. Patient was asymptomatic 8 months ago but started experiencing a swelling with respect to lower right half of the face. Swelling was small initially. Patient visited a local dentist who extracted a tooth from lower right back region. Swelling had gradually increased to its present size. No history of trauma was noted. There was no history of any other disease affecting the jaw or other bones. Medical and family history were noncontributory.

On extraoral examination, a diffuse swelling was present on the right side of face, extending from the zygoma inferiorly 2 to 3 cm below the chin. Anteriorly, it extended from just beyond the midline (left side) to the right preauricular region (Fig. 1). Anteroposteriorly, it measured about 12 × 9 cm in size. Overlying skin was normal but tensed and not associated with any sinus or fistula. Borders of the swelling were poorly demarcated (Fig. 2). There was no evidence of extraoral draining sinus. Temperature of the overlying skin was normal. An intraoral examination revealed an ill-defined, diffuse, ulceroproliferative lesion showing bicortical expansion obliterating the buccal and lingual vestibular spaces on the right side of the mandible. The soft tissue growth showed indentations of the maxillary teeth. Mucosa over the swelling was inflamed (Fig. 3). Floor of the mouth was raised on the right side. On palpation, the swelling was tender and hard to firm in consistency. Grade II mobility was seen in all teeth from 33 to 47. Orthopantomograph (OPG) showed a diffuse radiopacity with a sunburst appearance on right side of the mandible extending from 45 to 48 region (Fig. 4). Periodontal widening of the lower anterior teeth along with two root pieces and two missing teeth was seen. Computed tomography (CT) scan showed bone forming malignant mass of 8 × 4 cm approximately arising from right hemimandible with sunburst periosteal reaction and not breaking the lingual border of the mandible. Externally, it extended up to subcutaneous tissue. Superiorly, the lesion extended up to the level of maxillary alveolus and inferiorly up to submandibular

Fig. 1: Extraoral view shows a diffused swelling present on right side of face with no surface ulceration

Fig. 2: Extraoral view shows swelling extending from zygoma to 2 to 3 cm below the chin. Anteriorly it extends from just beyond the midline (left side) to right preauricular region

Fig. 3: Intraoral view shows an ill defined, diffused ulceroproliferative lesion showing indentation of maxillary posteriors, bicortical expansion obliterating the buccal and lingual vestibular spaces

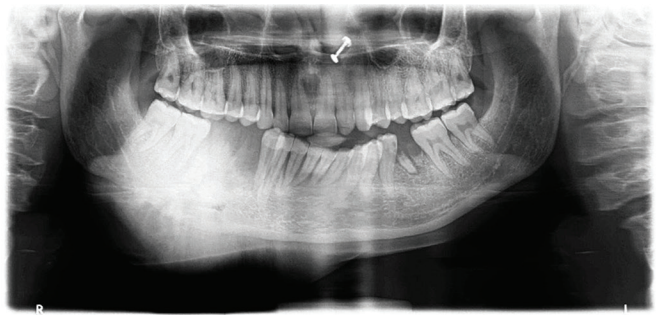


Fig. 4: Orthopantomography view shows diffuse area of increased radiopacity in relation to right side of the mandible having radiating appearance at the periphery (sunburst appearance)

soft tissue (Fig. 5). Three-dimensional (3D) reconstruction image confirmed the extent of the lesion (Figs 6A and B).

Considering the clinical features, the sudden increase in size of the swelling, consistency of the lesion, and the patient's age, a provisional diagnosis of OS, fibrosarcoma, and malignant ameloblastoma were made. An incisional biopsy was performed and sent for histopathological examination.

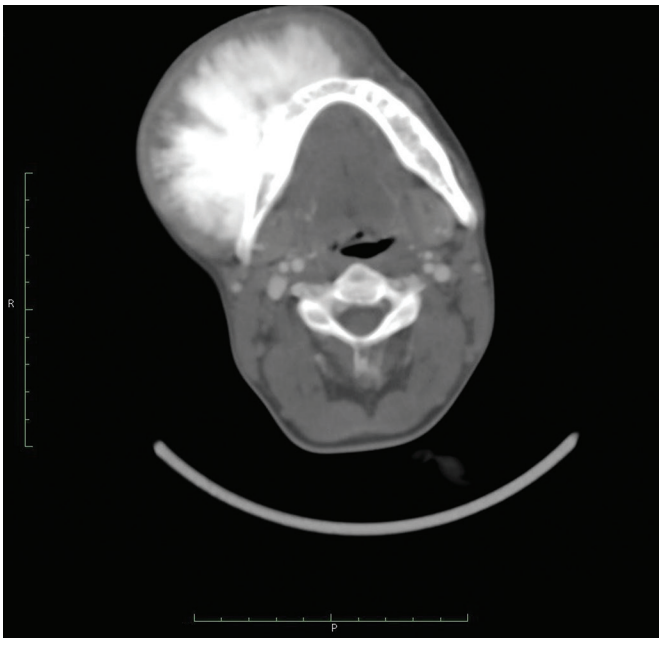
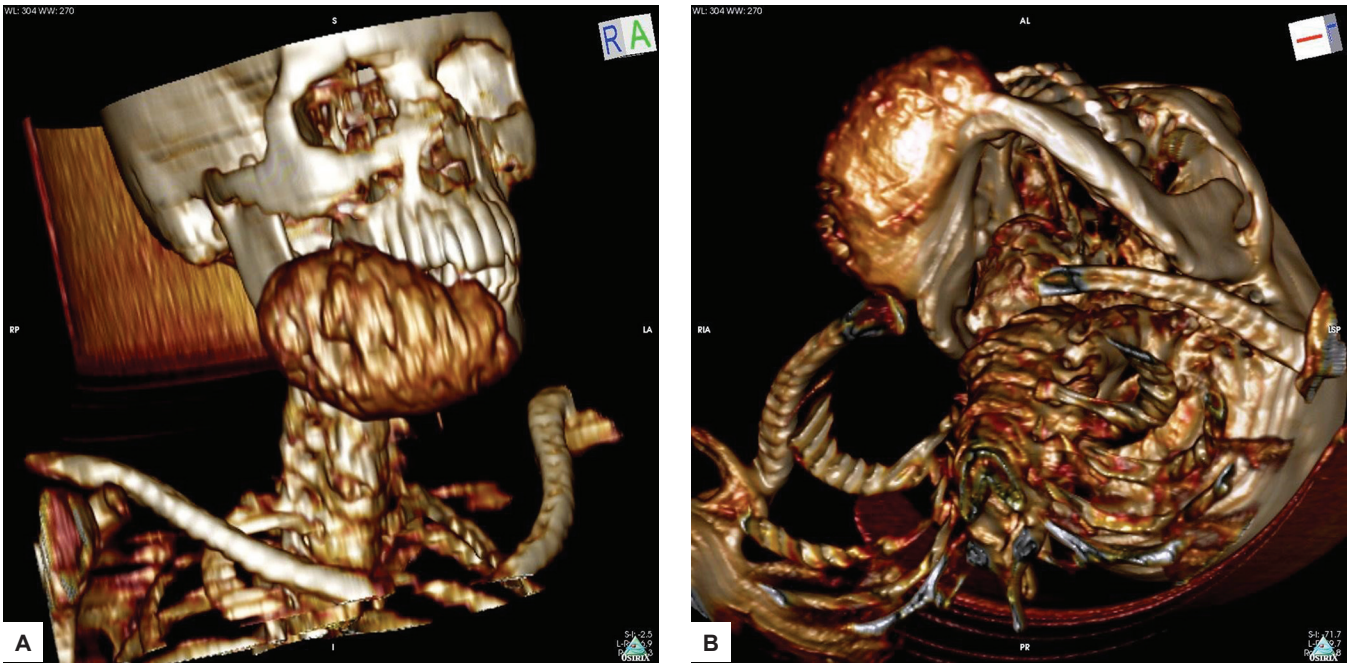


Fig. 5: Computed tomography scan shows bone forming malignant mass arising from right hemimandible with sunburst periosteal reaction

Hematoxylin and eosin-stained soft tissue section showed hypercellular areas of spindle shaped osteoblasts with malignant tumor osteoid (Fig. 7). Malignant osteoid showed variable areas of mineralization interspersed among the tumor cells (Fig. 8). The tumor cells exhibited marked pleomorphism, hyperchromatism, and increased mitotic activity (Fig. 9). Thus, the diagnosis of osteoblastic OS was given. Hemimandibulectomy of right mandible was planned but patient refused to undergo treatment.

DISCUSSION

According to WHO 2005,[6] OS is defined as a primary malignant tumor of bone in which the neoplastic cells produce osteoid or bones. It accounts for approximately 20% of all sarcomas and are the most common primary bone tumors excluding hematopoietic neoplasms.[7,8] Approximately 6 to 8% of OS occur in the jaws.[2] Osteosarcoma are classified as primary and secondary (Table 1).[9] Our present case belongs to conventional osteoblastic variant of OS.



Figs 6A and B: Three-dimensional reconstruction image confirming the extent of the lesion

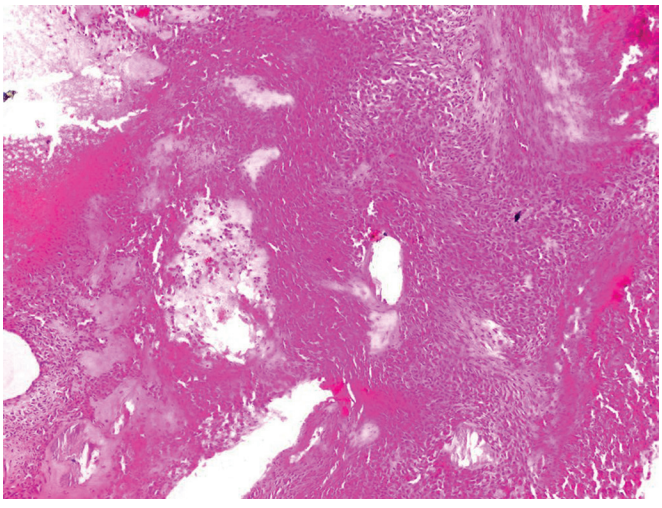


Fig. 7: H&E (40×) stained soft tissue section shows hypercellular areas of spindle shaped osteoblasts

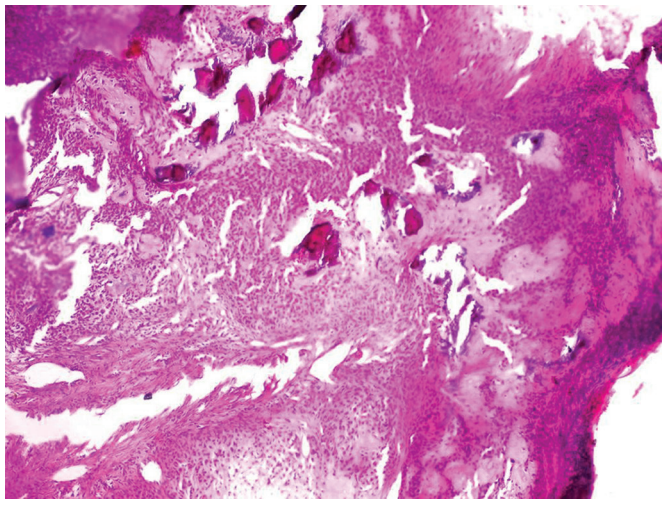


Fig. 8: H&E (100×) stained soft tissue section shows presence of malignant osteoid showing variable mineralization interspersed among the tumor cells

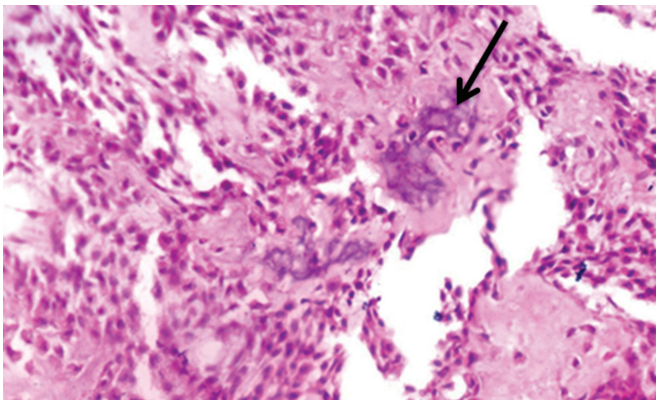


Fig. 9: H&E (100×) stained soft tissue section shows osteoblasts exhibiting marked pleomorphism, hyperchromatism and increased mitotic activity with areas of tumor osteoid (arrow)

The exact cause of OS is unknown. However, a number of risk factors do exist. Osteosarcomas can arise *de novo* or in several preexisting bone abnormalities such as Paget's disease, fibrous dysplasia, multiple osteochondromas, bone infarct, chronic osteomyelitis, and osteogenesis imperfect.[7] Exposure to radiation is an environmental risk factor.[10] Genetic mutations in tumor suppressor gene p53 and mutated retinoblastoma (RB) gene are the other etiological factors. In patients with RB, OS occurs 500 times more frequently than in the general population.[11]

The most common sites of OS include femur (42%), tibia (19%), humerus (10%). In jaw OS, mandible is more commonly involved than maxilla, with the mandible

Table 1: Classification of OS

Primary OS
Conventiaonal – intramedullary central high grade (most common) further sub-typed as:
Osteoblastic (50%)
Chondroblastic (25%)
Fibroblastic (25%)
Small cell
Telangiectatic
Low grade central
Surface OS:
Parosteal
Periosteal
High grade surface
Secondary OS can occur in Paget's disease and after radiation exposure.
Unusal forms of OS given below are viewed as subtypes of conventional OS because their behavior is similar.
Osteoblastic OS-sclerosing type
Osteosarcoma resembling OS
Chondromyxiod fibroma-like OS
Chondroblastoma-like OS
Clear cell OS
Malignant fibrous histocytoma-like OS
Giant cell OS
Epitheliod OS

Table 2: Comparison of Gnathic and Extragnathic OS

	Gnathic OS	*Extragnathic OS*
Age	Most often in 3rd and 4th decade of life	Bimodal age of distribution (10–20 and 50 yrs)
Common Site	Mandible	Distal femur and proximal tibial metaphyses
Metastasis	Less tendency to metastasize	More metastatic potential
Prognosis	• Less aggressive and more favorable prognosis compared to extragnathic OS. • The worst prognosis is associated with maxillary antral OS and mandibular symphysis OS have the best prognosis. • Chondroblastic variant histopathological shows worst prognosis.	Aggressive and poor prognosis
5 years Survival rate	50%	30%

accounting for 44 to 73% of cases and that of in maxilla is about 27 to 56% of cases. Mandibular tumors arise more frequently in body of mandible accounting 55 to 75% of cases followed in order of frequency by the angle, the ramus, and the symphysis.[12] Jaw OS commonly presents itself in the 3rd and 4th decades of life.[8] A comparison of gnathic and extragnathic OS is given in (Table 2).[4,8,13,14] Forteza et al[15] did a study on 81 cases of OS and found that maxillary OS occurred in females with the ratio of 4:1, whereas mandibular lesions occurred only in males. The present case is rare, as it occurred in a 30-year-old female. The most common symptom of OS in the head and neck region is pain, swelling, mucosal ulceration, and loosening of teeth, which were also observed in our patient.

Radiographically, OS of the jaw has a purely lytic and destructive pattern (35–45%), a sclerotic pattern (5–65%), and mixed pattern of lysis and sclerosis (22–50%).[12] A sunburst pattern with radiating spicules of bone is considered a characteristic feature of OS of the jaw. It occurs only in 7 to 27% of cases.[12] The present case showed the classic sunburst pattern.

Histopathologically, on the basis of the amount of osteoid cartilage or collagen fibers produced by tumor, they are classified as osteoblastic, chondroblastic, and fibroblastic.[12] The osteoblastic variety consists of tumor osteoid surrounded by bizarrely arranged fibroblast-like cells.[16] In chondroblastic OS, tumor cells lie in the lacunae and form lobules. The center of the lobule has bony trabeculae producing a feathery appearance, and toward the periphery, the tumor becomes hypercellular. Most of the times, an area of atypical chondroid tissue is also seen with large chondrocytes. Fibroblastic OS is the least common variant where the tumor cells are spindle-shaped. According to Garrington's study on 56 cases of jaw OS, 60% were osteoblastic, 34% were fibroblastic, and less than 10% were of chondroblastic variant.[10] The present case exhibits features of osteoblastic variant of OS.

Surgery and adjuvant chemotherapy radiotherapy may be required sometimes. The need of adjuvant therapy depends on the presence of micrometastases. In mandible, hemimandibulectomy is commonly preferred. A subtotal inferior maxillectomy for selected malignancies located on the alveolar ridge, palate and involving the antral floor have been described in literature.[17] Overall, 5-year survival rate of 50% is reported for jaw OS.[4] Patients with mandibular tumors generally fair better than those with maxillary tumors. Recurrence rate of OS of jaw is about 40 to 70% with a metastatic rate of 25 to 50%.[7] Osteosarcomas are more likely to metastasize to lung and to brain than to regional lymph nodes.[7] In the present case, the patient refused to undergo treatment and was lost to follow-up.

CONCLUSION

Osteosarcoma is a very aggressive neoplasm of OS origin with a potent risk of metastasis. Early diagnosis of this lesion may have a bearing on better prognosis and survival rate. Hence, a triple diagnostic approach, that is, clinical, radiological, and histopathology, is essential for an accurate and timely diagnosis.

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CASE REPORT

Correction of Skeletal Sagittal Dysplasia using Twin Block Traction Technique

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ABSTRACT

The primary concern of the patient as well as their parent seeking orthodontic treatment is the sagittal relationship of the dentition and jaws. Twin block is the most common functional appliance used successfully in correction of growing patient with skeletal class II malocclusion. However, the method of using extraoral traction in combination with twin block appliance (twin block traction technique) is to reinforce the functional component for correction of a class II sagittal relationship. A 12-year-old male patient reported to the Department of Orthodontics with a chief complaint of forwardly placed upper front teeth. With the help of clinical examination, cephalometrics, and diagnostic records, the diagnosis of the patient was confirmed as skeletal class II maxillomandibular relationship with prognathic maxilla and retrognathic mandible with a vertical growth pattern. The patient was treated with twin block appliance along with headgear. The appliance design and postfunctional results are demonstrated in the following case report. Although twin block with high-pull headgear is known to produce favorable results in mixed dentition, the same was observed in permanent dentition during growth phase. Combination of twin block appliance with high pull headgear gave the desired results.

Keywords: Extraoral traction, High-pull headgear, Skeletal class II, Twin block,

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Conflict of interest: None

INTRODUCTION

The primary concern of the patient as well as their parent seeking orthodontic treatment is the sagittal relationship of the dentition and jaws. The most commonly observed sagittal problems are skeletal class II maxillomandibular relationship,[1] affecting about one-third of the examined patients seeking orthodontic treatment.[2] Skeletal class II malocclusions occur due to various factors, such as maxillary protrusion, mandibular retrusion, or a combination of the aforementioned, together with abnormal dental relationships and profile discrepancy.[3] McNamara[4] reported mandibular retrusion to be the most common characteristic in a skeletal class II malocclusion.

Treatment modalities for a skeletal class II patient include various removable and fixed functional appliances to stimulate the mandibular growth by forward positioning of the mandible.[5-8] Growth remodulation and/or redirection is possible only in growing patients. Adult patients suffering from skeletal class II problems are treated with fixed appliance alone or in combination with orthognathic surgery. However, the severity and the nature of dysplasia are the crucial factors in deciding the treatment modality.[9]

In most cases, twin block appliance without the need of an additional orthopedic or tractional force can help in achieving functional occlusion. Twin block appliance along with orthopedic traction is to be considered in cases wherein the response to functional correction is expected to be poor. However, this approach of using functional therapy with extraoral traction should be used in treating cases with severe malocclusion. The indication for functional therapy with orthopedic traction is confined to cases requiring intrusion and distalization of maxilla or maxillary dentition, in cases with vertical growth pattern requiring intrusion of posterior segment of maxilla, and in adult patients for correction of severe malocclusion.[10,11]

CASE REPORT

A 12-year-old male patient reported to Department of Orthodontics and Dentofacial Orthopedics with a chief complaint of forwardly placed upper front teeth. On extraoral examination, it was found that the patient had a convex profile, incompetent lips with an interlabial gap of 4 mm, short upper lip length (14 mm), acute nasolabial angle, receded chin and deep mentolabial sulcus, and vertical growth pattern. On intraoral examination, the case was classified as Angle's class II Division I malocclusion with class II molar and canine relationship bilaterally with an increased overjet of 10 mm and overbite of 5.5 mm. The pre-treatment extraoral and intraoral photographs (Figs 1 and 2) were recorded.

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Fig. 1: Pretreatment extraoral photographs

Fig. 2: Pretreatment intraoral photographs

Fig. 3: Pretreatment lateral cephalogram

The case was diagnosed as skeletal class II malocclusion with a combination of maxillary excess and mandibular deficiency. Cephalometric analysis showed skeletal class II sagittal relationship and vertical growth pattern. Evaluation of patient's cervical radiograph indicated considerable amount of growth remaining. The pretreatment lateral cephalogram is shown in (Fig. 3).

TREATMENT OBJECTIVES

- Correction of skeletal sagittal dysplasia (class II maxillomandibular relationship);
- Reduction in the convexity of profile;
- Achievement of class I molar and canine relation;
- Achievement of normal overjet and overbite.

TREATMENT PLAN

In order to correct the skeletal class II maxillomandibular dyplasia, restrict maxillary growth, and redirect mandibular growth, growth modification was planned using functional appliance. Twin block appliance with high pull headgear in the first stage followed by fixed orthodontics appliance for final finishing and detailing of occlusion.

Twin block appliance with headgear tubes and capping of lower incisors to prevent flaring along with high pull headgear was worn for a period of 14 months (Figs 4 and 5). Remarkable correction in sagittal skeletal dysplasia along with achievement of class I molar and canine relation bilaterally with significant reduction in overjet and overbite was observed. Postfunctional extraoral and intraoral photographs are shown in (Figs 6 and 7). The improvement in profile is shown in (Fig. 8). Skeletal

Fig. 4: Mid treatment extraoral photographs

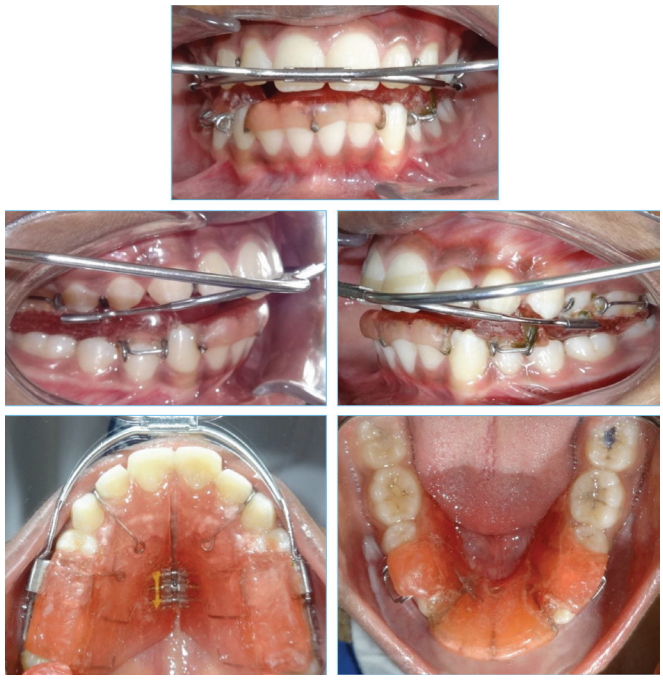

Fig. 5: Mid treatment intraoral photographs

Fig. 6: Postfunctional extraoral photographs

Fig. 7: Postfunctional intraoral photographs

Fig. 8: Extraoral photographs (profile view)

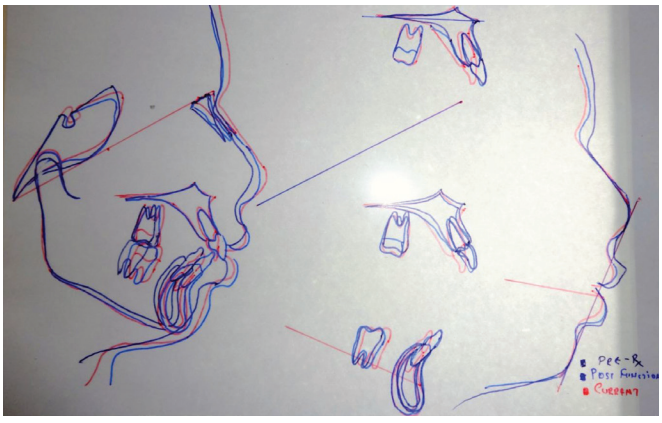

Fig. 9: Superimposition of serial lateral cephalogram using Rickkets superimposition method

improvement is as shown with superimposition of serial lateral cephalograms (Fig. 9).

DISCUSSION

Various combinations of skeletal and dental component may contribute to skeletal class II malocclusion. Therefore, identifying the etiology and understanding the expression of class II malocclusion is helpful in correcting the discrepancy and selecting the modalities of treatment, whether functional, orthodontic, and surgical or a combination of the aforementioned.

Twin block is the most commonly used removable functional appliance, based on the concept of functional occlusion, occlusion inclined plane, and proprioceptive stimulus.[10,11] It enables the patient to perform masticatory function, speech, lateral excursion, and other jaw functions very comfortably; patients wear the appliance full time with little discomfort. In comparison with other functional appliances, its fabrications as well as repair are not technique sensitive and can be used in mixed dentition, deciduous dentition, and sometimes in permanent dentition.[12]

Several studies have been performed and have documented the skeletal and dentoalveolar effects of twin block in tandem with extraoral traction for correction of class II malocclusion.[13,14]

In this case when comparison of pretreatment and postfunctional cephalometric parameters was done, Angle between Sella, Nasion and Point A (SNA) remained the same, and Angle between Sella, Nasion and Point B (SNB) changed by 5°, reducing the Angle between Point A, Nasion and Point B (ANB) angle from 8 to 3°. Table 1 represents the cephalometric parameters before and after the twin block traction technique.

CONCLUSION

Use of twin block traction technique resulted in functional correction with restriction of maxillary growth and sagittal correction of the mandibular base.

Table 1: Cephalometric analysis

Parameters	*Pretreatment*	*Postfunctional*
Facial angle (FH-N-Pog)	80°	85°
Angle of convexity (N-A-Pog)	14°	8°
SNA	79°	79°
SNB	71°	76°
ANB	8°	3°
Upper Incisor—NA (Degree)	27.5°	25°
Upper Incisor—NA (mm)	7.5 mm	6 mm
Lower Incisor—NB (angle)	33°	39°
Lower Incisor—NB (mm)	8 mm	8 mm
BO-AO (Wits appraisal)	+4 mm	+1 mm
FMA	27.5°	24°
FMIA	42.5°	46°
IMPA	110°	110°
Anterior cranial base length (Se-N)	63 mm	63 mm
Extent of maxillary base (PNS-Pt. A')	43 mm	43 mm
Extent mandibular base (Go-Pog)	63 mm	65.5 mm
N Perp—A	–3 mm	0 mm
N Perp to Pogonion	–17 mm	–6 mm
Facial Angle	80°	85°
Convexity at Pt. A	+6.5 mm	+3.5mm

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CASE REPORT

Rejuvenating Smile with All-ceramic Crowns

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ABSTRACT

Smile enhancement for a patient instills self-confidence by rendering an attractive smile. All-ceramic restorations have the potential to replicate the natural esthetics close to natural dentition, i.e. lacking in metal ceramic restorations. A young female patient unhappy with her smile was rehabilitated with all-ceramic restorations; thereby, the beauty of an individual within the functional and physiological functions could be restored. The final outcome with regard to esthetics and function was found to be good.

Keywords: All-ceramic restorations, Lithium disilicate, Smile enhancement.

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INTRODUCTION

Esthetics is of prime importance to patients, as it has a huge impact on the self-esteem. The desire to mimic natural tooth characteristics has made esthetic dentistry one of the areas of greatest demand.

Metal ceramic restorations have been the choice for more than three decades. They gained popularity for their predictable performance and reasonable esthetics. Despite their success, the demand for improved esthetics has led to the introduction of all-ceramic restorations.[1,2] These restorations have the potential to replicate the appearance of the natural dentition. Significant developments in all-ceramic materials have created wonderful opportunities for the fabrication of life-like restorations that provide reliable and long-term results. Lithium disilicate, one of the high-end all-ceramic esthetic material, helps in achieving more esthetically pleasing restorations making it replace the time-tested metal ceramic restorations.[3,4]

This case report presents the rehabilitation of a patient with prominent maxillary anterior teeth with lithium disilicate all-ceramic material restoration.

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CASE DESCRIPTION

A 25-year-old female patient reported to the Department of Prosthodontics with a chief complaint of an unattractive smile due to prominent anterior teeth that restrained her from smiling. Patient had a history of orthodontic treatment 2 years back. She had a prominent crown on 21. No relevant medical history was given by the patient.

On extraoral examination, patient had an ovoid facial form with a convex facial profile. Patient revealed a reverse smile with an average smile line displaying the gingival embrasures. Patient had an average lip length with thin upper lip and normal lower lip. The width of buccal corridor was adequate (Fig. 1).

On intraoral examination, the maxillary anterior teeth showed severe proclination that posed a negative effect on the smile of the patient. Patient had a prominent metal ceramic restoration with 21 and had an overjet of 5 to 6 mm and overbite of 2 to 3 mm from 12 to 22. Canines were in proper position but discolored. Patient's upper dental midline coincided with facial midline, but upper dental midline did not coincide with lower dental midline. Patient had a canine-guided occlusion and patient's periodontal status was good (Fig. 2).

Fig. 1: Preoperative extraoral

Fig. 2: Preoperative intraoral

On radiographic examination, intraoral periapical radiograph (IOPA) with 21 showed root canal treatment that had proper obturation (Fig. 3); the orthopantomography (OPG) showed adequate bone and the dental status of the other teeth were good. Lateral cephalometric radiograph analysis concluded that the maxilla was more prominent (Fig. 4).

Diagnostic impressions were made in irreversible hydrocolloid and poured in dental stone to obtain a diagnostic cast that was analyzed. A diagnostic wax up was carried out considering the principles of smile designing.[5-7] The position of the teeth was changed to get form and size to suit the patient and reduce the proclination to achieve the desired results. Two putty indices were made, one was used to aid in preparation and the other was used to make the provisionals. As the occlusion was canine-guided, the point contact was also given on premolar teeth to reduce the load on maxillary canine restorations by carrying out enameloplasty of mandibular canines.

At first, scaling and polishing was carried out for both the arches. The old metal ceramic crown was cut away with carbide bur to protect the tooth structure. To correct the proclination for the desired results, it was planned to carry out endodontic treatment followed by i-post and composite core for 11, 12, 21 and 22 (Fig. 5). It was decided to restore the anterior esthetic zone using the lithium disilicate restorations. The consent of the patient was taken.

The shade of the mandibular teeth was selected as A1 using the Vita easy shade spectrophotometer. Tooth preparation was carried out with diamond point for incisors to receive full coverage lithium disilicate crowns to correct the severe proclination. All the

Fig. 3: Intraoral periapical showing RCT on 21

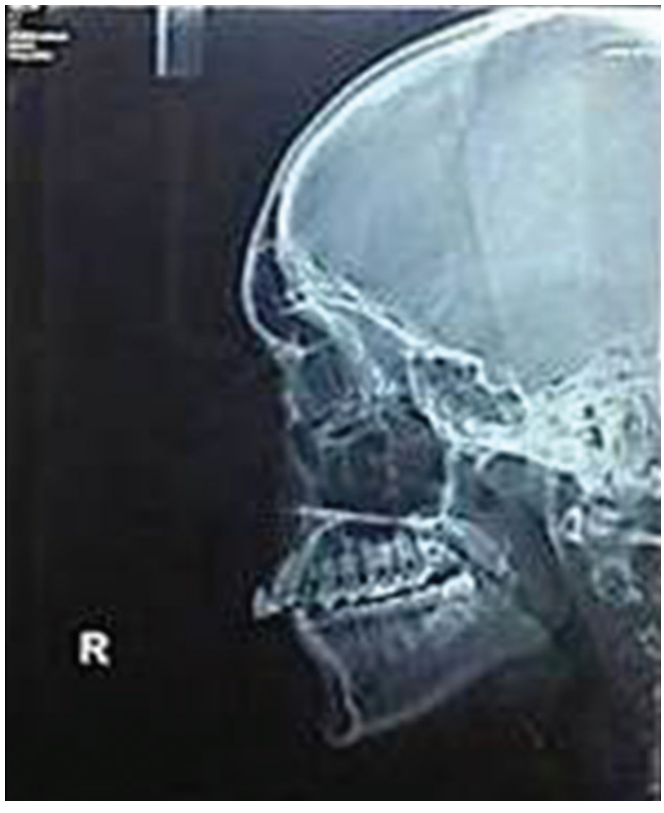

Fig. 4: Lateral cephalogram

Fig. 5: Intraoral periapical with i-post

incisors were prepared with an equicrevicular chamfer finish line.

As maxillary canines were discolored and did not require repositioning, the preparation was carried out conservatively to receive porcelain laminates and preparations were kept in enamel at a depth of 0.5 mm using a depth-cutting diamond and a tapered diamond point (Fig. 6). The proximal preparation was extended beyond the contact area to avoid visibility of the tooth restoration junction.[8] The silicon putty index was used to act as a preparation guide to verify the facial and incisal reduction as well as to confirm the uniformity in the thickness of porcelain (Fig. 7).

Fig. 6: Tooth preparation

Mechanochemical gingival retraction was carried out with a knitted cord impregnated with 23% aluminum chloride. Once the preparation was completed, final impression was made using polyvinylsiloxane impression material by the two-stage double-mix technique (Fig. 8). Final impression was poured in type IV Gypsum to obtain a working cast using Pindex system.

Putty index was used to make provisional restorations with Protemp using direct technique immediately after the preparation of the teeth. The provisionals were assessed for shape and position of the teeth, whether it achieved the desired results (Fig. 9). This outcome was shown to the patient and her approval was taken so that this could be replicated in final restorations.

Porcelain lithium disilicate restorations for full coverage crowns and laminates were fabricated by the pressing technique using the correct shade ingot to obtain lithium disilicate restorations. The bisque trial of restorations were tried in for shade, fit, marginal

Fig. 7: Putty index to determine tooth reduction

Fig. 8: Final impression

Fig. 9: Provisionals

adaptation, shape, size, symmetry, contacts, and the amount of visibility of the restoration at rest position and when the patient smiles. The occlusion was checked in centric and eccentric position and any interferences were removed. Patient's approval was obtained at the time of try-in. The final glazing was carried out.

At the luting appointment, the restorations were arranged denoting the position of the tooth in the arch to avoid incorrect placement. The procedure for luting was performed first on central incisors followed by lateral incisors and then the canines. Dual cure luting agent Rely X U200 [3M ESPE] was used for luting.

The lithium disilicate restorations were etched with 10% hydrofluoric acid for 20 seconds. After etching, they were washed thoroughly using liberal amount of water. On drying, a coat of silane coupling agent was applied for 60 seconds.

The prepared teeth were etched using 37% phosphoric acid for 15 seconds on incisors because it was in dentin and 30 seconds for canines as the preparation was in enamel, they were washed and air-dried. Then bonding agent was applied and light cured for 10 seconds on all prepared teeth. The restorations were spot cured for 5 seconds initially. Excess cement was removed with explorer and then complete curing was done for 20 seconds. The patient was satisfied with her new smile line and excellent alignment of the anterior teeth (Figs 10 to 12).

Fig. 10: Postoperative intraoral

Fig. 11: Preoperative extraoral

Fig. 12: Postoperative extraoral

DISCUSSION

Proclined anterior teeth can be treated with orthodontic treatment; however, orthodontic relapse had taken place and therefore, repeated orthodontic treatment was not acceptable to the patient. Hence, it was planned to treat her with all-ceramic crowns to reposition the proclination.

In the present case, treating the patient only with all-ceramic crowns without any endodontic treatment was not sufficient; intentional root canal treatment of maxillary incisors was carried to change the alignment of the teeth. As the proclination was not severe, it could be managed by prefabricated i-post with composite build-up; therefore, one-piece cast post and core was not needed in this case. Canines were treated conservatively with porcelain laminates, as they were discolored and did not require repositioning. The proclination of the teeth was corrected changing the reverse smile into a convex smile making the smile esthetically more pleasing (Fig. 13).

CONCLUSION

This is an interesting case wherein all-ceramic restorations were employed to optimally rejuvenate an unesthetic smile. Although the patient had orthodontic treatment that relapsed, this could be treated with prosthetic rehabilitation using all-ceramic restorations. The patient was more confident with the esthetically pleasing outcome and did not experience any phonetic problems resulting from the correction of the tooth alignment. The new smile of the patient was satisfactory with excellent esthetic appearance (Fig. 14).

Detailed planning, correct selection of dental materials, and quality communication with the prosthetic technician contributed to a harmonious smile and the evident satisfaction of both patient and dental professionals (Fig. 13).

Fig. 13: Smile curve

Fig. 14: Postoperative extraoral

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CASE REPORT

Masking Conventional Metallic Cast Post for Enhancing Esthetics

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ABSTRACT

Loss of tooth structure occurs due to caries, endodontic treatment, or fracture caused by trauma; restoring these teeth is difficult task for a clinician. Post and core is an option for teeth when excessive tooth structure is lost and teeth need to be restored with crown and bridge procedure. They can be prefabricated post with composite built up or a one-piece custom-made post. The custom-made cast metal post and core have disadvantage due to their color that imparts grayish hue to overlying ceramic restorations. Masking the metal core can enhance the esthetic of all ceramic restorations that are placed over the cast post and core. A case report is being presented where the metallic core was masked with ceramic built up on labial surface of metal core.

Keywords: All ceramic restorations, Lithium disilicate, Metal cast post, Post and core.

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INTRODUCTION

Post and core are regarded as the foundation restoration for mutilated dentition.[1] Post is required for retention of core and reinforcement of tooth structure. For post and core to be successful, a ferrule of 2 mm is mandatory; this can be achieved by preservation of remaining tooth structure, crown lengthening, or orthodontic extrusion.[2]

The post and core can be prefabricated post with composite built-up core or a one-piece custom-made post and core that can be in metal or zirconia material.[3] The custom-made post and core are indicated in situations wherein gross tooth structure is lost, teeth having wide canals, anterior deep bite, and where a change in angulation is required for enhancing esthetic by repositioning of restoration in the arch.[3]

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The zirconia post and core may be used for their esthetic outcome but are more expensive and difficult to fabricate.[4] A metal post and core is used routinely in practice; however, its esthetic outcome when placed under all ceramic restorations is not acceptable due to the grayish hue imparted to the final restoration. The labial surface of the metal core can be masked with ceramic layer after the casting of cast post and core. This will enhance the outcome of the final all ceramic restorations and give a successful esthetic result.

A case wherein anterior fracture teeth were restored with a masked metal core and all ceramic crown and bridge is presented in this article.

CASE REPORT

A 28-year-old male patient reported to the Department of Prosthodontics with the chief complaint of dislodged anterior crowns, swelling, and pain in upper anterior region. He desire relief of pain and improvement of esthetic. Past dental history revealed that the patient had undergone root canal treatment with 11, 12, and 21; periapical surgery was done with 11 and 12 and restored with porcelain fused to metal crowns. The crowns along with the prepared teeth were dislodged. Family, medical, and personal history was not relevant.

Extraoral examination showed that the patient had square facial form and flat facial profile due to loss of anterior teeth. The lip length was average. On smiling, a space of anterior missing teeth was visible (Fig. 1).

Fig. 1: Extraoral

Fig. 2: Intraoral

Fig. 3: Provisional restoration with ovate pontic design placed after surgery

Intraoral examination showed missing 12. Fracture with 11 and 21 was till gingival level. Intraoral sinus with 11 and pain on percussion was positive with 11 and 21. Caries was seen with 26, 36, 37, 46, and 47. The patient had poor oral hygiene along with gingival inflammation in relation to upper anterior region (Fig. 2). The edentulous area with 12 showed loss of vertical height that would make it difficult to place an esthetic pontic.

Intraoral periapical radiographic examination showed incomplete obturation with 11 and 21 and large periapical lesion with 11.

Study models were made from diagnostic impression and analyzed for determining treatment plan for anterior all-ceramic restoration. A diagnostic mock-up was done on the study model and putty index was prepared. A mock-up trail was done directly into patient mouth using the putty index and Protemp for diagnostic planning of final restoration and approval of patient was taken on esthetic outcome of the provisional restoration prior to planning the other procedure.

A multidisciplinary treatment was planned for the patient that involved endodontic treatment, periodontic management, and prosthetic rehabilitation. Following treatment was carried for the patient.

Scaling and polishing was done for both the arches. Pre-operative radiograph showed incomplete obturation with 11 and 21 and large periapical lesion with 11; therefore, root canal treatment was repeated with 11 and 21 and periapical surgery was carried out with 11. Intentional root canal treatment was carried out with 13, as adequate tooth structure was not available for restoration and tooth preparation would have led to exposure of pulp as the pulp horn was large. Provisional restoration with ovate pontic design was made with the help of putty index. Ridge defect was observed in relation with 12 that would have affected final esthetic outcome. So, modified Abrahams technique was followed to overcome the ridge defect and to achieve the desired emergence profile.[5] In this method, a de-epithelialized palatal flap was dissected and a pedicle was displaced toward the buccal aspect of the ridge. The connective tissue was then rolled below the buccal flap in the area of the deformity in order to correct bucco-lingual ridge defect.[5] Crown lengthening was simultaneously carried out with 11 and 21 to achieve adequate ferrule. Provisional restoration, which was already fabricated, was cemented immediately after the surgery. Patient was on provisional restoration for 6 months for the development of pontic site (Fig. 3).

An all-ceramic restoration was planned for the patient, as he had high esthetic demand. Shade selection was done using spectrophotometer by placing it on adjacent tooth and shade was noted.[6] Tooth preparation was done to achieve the desired ferrule. Indirect technique was followed for cast postfabrication.[3] A custom-made resin post was fabricated to fit the canal two-third its length and picked up in an irreversible hydrocolloid impression material (Figs 4 and 5).

Wax patterns were fabricated with casting wax, casted, and finished. Their fit was checked on the master cast and intraoral trail of cast post was done (Fig. 6). Radiograph was taken to determine the length and fit of the cast post (Fig. 7). Metal on the labial surface was removed to achieve space for masking material and

Fig. 4: Acrylic post into the canal

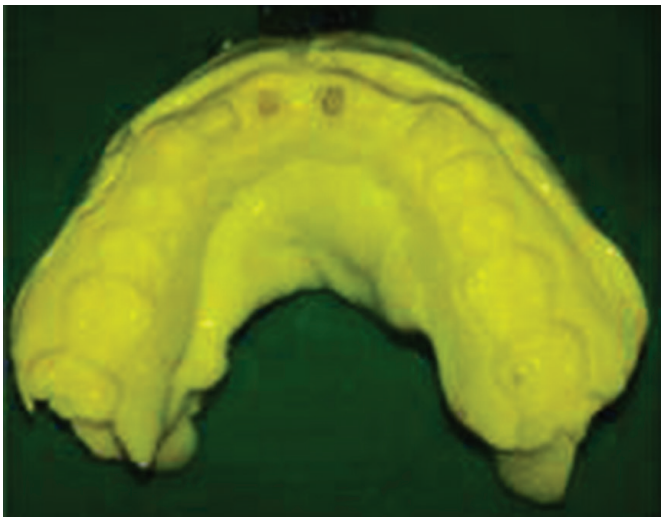

Fig. 5: Impression for cast post fabrication

Fig. 6: Intraoral trial of cast post

Fig. 7: RVG before cementation of cast post

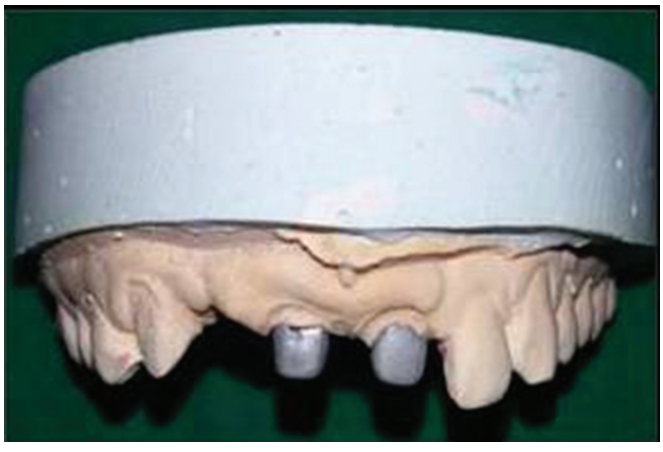

Fig. 8: Cast post and core after sandblasting

Fig. 9: Cast post and core after application of ceramic opaquer

sandblasted with aluminum oxide powder to achieve rough surface. Ceramic opaquer was fired on it to mask the color of the metal (Figs 8 and 9).

Cementation of cast post was done with zinc phosphate cement.[7] Final impression was made with addition silicone in two stages and cast was poured in Type IV gypsum for the fabrication of lithium disilicate crown and bridge. The wax pattern planned for the lithium disilicate restoration replicated the provisional restoration in its form specially the pontic that was an ovate pontic contoured well to fit the developed edentulous site. Final crown and bridge was fabricated by pressed technique using lithium disilicate ingots. The bisque trail was done to determine the fit, esthetic, and occlusion of the crown and bridge restoration. It did not reveal the underlying unesthetic metal because of the masked metal core. The final glazing of the restoration was carried out and was ready for cementation.

For cementation procedure, etching of ceramic was carried out with 10% hydrofluoric acid for 15 seconds (Fig. 10). Simultaneously, intraorally canine and remaining tooth structure was etched with 37.5% of orthophosphoric acid for 15 seconds, as the preparation was in dentin (Fig. 11). Metal core of cast post was not etched,

as it was rough. Etched surface was thoroughly washed with water and dried. It showed white frosted appearance of both tooth and ceramic. Silane application was done on ceramic; simultaneously, bonding agent was applied on canine and remaining tooth structure. It was light cured for 10 seconds. Final crown and bridge cementation was done with dual cure resin cement using Rely X U 200 (Fig. 12). Patient was happy and satisfied with the treatment (Figs 13 to 15). Patients recall was done after 24 hours, 1 week, 1 month, and 3 months.

Fig. 10: Silane application

Fig. 11: Etching of tooth with orthophosphoric acid

Fig. 12: Light curing of dual-cure resin cement

Fig. 13: Postoperative intraoral

Fig. 14: Preoperative extraoral

Fig. 15: Postoperative extraoral

DISCUSSION

Gross destruction of teeth poses a restorative challenge for the clinician. Post and core restoration are boon for managing such teeth. For post and core restoration, at least 2 mm of ferrule is essential.[3] In this case, the remaining tooth structure of both central incisors was inadequate for post and core restoration. Orthodontic extrusion require long time period, so crown lengthening was carried out in 11 and 21 to achieve desire ferrule.

Selection of post depends on several factors, namely the amount of remaining tooth structure, position of teeth, occlusion of patient, and many others. The masked metal cast post was suggested as the treatment option for 11 and 21, as the amount of remaining tooth structure was inadequate to restore with prefabricated post and composite core built up. Zirconia post was not selected, as it is difficult to fabricate and expensive.[3]

To achieve maximum esthetic, an ideal pontic should emerge from gingiva, support soft tissue and adjacent papillae. To manage ridge defect, several approaches of pontic site development are available. Among all the techniques, Abraham technique of palatal flap was used, as blood supply is maintained and it is a more conservative procedure.[5] Immediate provisional restoration with ovate pontic design helped in developing the pontic site.[8]

All ceramic restorations are trending in recent dentistry, as it has better esthetic advantage over porcelain metal restoration.[9] However, using such restoration over the metal core gives grayish hue to final restoration. The metal core needed to be mask to enhance the esthetic. Metal core can be masked either with composite or ceramic.[10] Composite requires specialized metal primer for adherence of it to metal core, whereas in case of ceramic, metal core needs to be sandblasted to create a rough surface. Thus, a ceramic opaque was used for masking the all-ceramic restoration that enhanced the esthetic of final restoration.

CONCLUSION

Today, the demand for all-ceramic restoration is increasing. But such restorations are difficult to use in cases wherein there is underlying metallic structure that will affect the esthetic value of all-ceramic restoration. This article presented a technique to mask the metallic hue of cast post to restore teeth with all-ceramic restoration giving a life-like appearance to restoration. Thus, a little modification gives better results and helps in achieving the desired esthetic output.

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CASE REPORT

Rehabilitation of a Patient with Immediate Complete Denture

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ABSTRACT

Patient's desire to have a replacement with complete dentures before losing all their natural teeth, this is important for the psychology of the patient. Patients with gross mobility of the teeth needing replacement with complete denture without going through a period of edentulousness has become mandatory for a prosthodontist to treat. An immediate denture is a treatment of choice for such patients. A case report is being presented for a patient with flared, prominent, mobile anterior teeth treated with a successful immediate denture.

Keywords: Immediate complete denture, Interim prosthesis.

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INTRODUCTION

Immediate denture is a complete or removable partial denture fabricated for insertion immediately following the removal of natural teeth. From patient's perceptions, it is better to have the teeth be replaced immediately after extraction for psychological reason and for being socially accepted. The advantage of an immediate denture is that it maintains patient's appearance, as there is no edentulous period. It also maintains the vertical dimension of occlusion, facial height, muscle tone, and tongue position. Anterior teeth size, form, and shade can be accurately replicated. Also, speech and mastication are not compromised and nutrition can be maintained.[1,2]

A well-made immediate complete denture acts as a splint over the surgical site and protects the wound against the injury of food and opposing teeth.[2] Therefore, there is less postoperative pain. The drawback of an immediate denture is that the final esthetic results may be questionable due to the inability to take an anterior try-in. Also, the retention and stability may not be as good as that of the conventional complete denture.[2-4] It is due to these technical difficulties that immediate complete dentures are considered as an Interim prosthesis.[1] They may require relining or a new set of dentures may need to be fabricated within a short period of time. However, tissue conditioners may be useful in such cases.[1]

A case report is being presented for a patient with flared, prominent, mobile anterior teeth treated with a successful immediate denture.

CASE REPORT

A 31-year-old female patient reported to the Department of Prosthodontics with the chief complaint of pain and inability to chew food due to mobility of teeth. She was unhappy because of proclined anterior teeth. On extraoral examination, the patient had a small face with prominent, proclined, long flaring anterior teeth. This caused incompetency of the lips (Fig. 1). Intraoral examination showed spacing due to flaring of the anterior teeth (Fig. 2). She had a deep maxillary palatal vault (Fig. 3) and crowding with teeth in mandibular arch (Fig. 4). Generalized grade II mobility and class III recession was present with teeth in both maxillary and

Fig. 1: Preoperative extraoral

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Fig. 2: Preoperative intraoral showing prominent premaxilla with proclined anteriors

Fig. 3: Preoperative intraoral showing deep palatal vault with 17, 26 root stumps

Fig. 4: Preoperative intraoral showing crowding in mandibular teeth and root stumps with 36 and 37

Fig. 5: Orthopantomography

mandibular arches. Root stumps were present with 16, 27, 36, and 37. On radiological examination, severe bone loss was seen in relation with all the teeth (Fig. 5).

The patient's teeth were not in a condition to be saved. Therefore, it was planned to extract all the teeth, but to prevent the patient from being edentulous, immediate complete dentures for maxillary and mandibular arches were planned. The following step-by-step procedure was followed for the entire treatment plan.

Diagnostic Impressions

Tooth and tissue undercuts were blocked in the patient's mouth with carding wax to prevent the interlocking of the impression material and diagnostic impressions of upper and lower arches were made in stock metal trays with irreversible hydrocolloid impression material. Care was taken to prevent the teeth on the cast from breaking by placing metal pins in places of the teeth in impression and casts were poured with dental stone and mounted on articulator for diagnostic purpose. Casts were evaluated and decision was made to fabricate an immediate complete denture.

The posterior teeth were extracted with minimum trauma for preservation of bone, sutures were given, and hemostasis was achieved. She was advised to continue medications and postextractions instructions were given to her. Patient was recalled after 7 to 10 days for assessment of healing of the posterior ridges.[1]

Final Impressions

Primary impressions of both the maxillary and mandibular arches were made with irreversible hydrocolloid, poured

with dental stone, and casts were obtained. Special trays were fabricated on the casts with adequate relief on the anterior teeth for the irreversible hydrocolloid. Border molding was carried out with low fusing impression compound and final impressions were made with irreversible hydrocolloid impression material (Figs 6 and 7). Impressions were poured in dental stone and casts were obtained.[1,3,4]

Jaw-relation Record

Temporary denture bases were adapted with shellac base plate on the casts; wax rims were made and kept ready for jaw relation. Vertical dimension was determined by Niswonger's method and the centric relation record was made following the static check bite method. A face-bow record was taken to orient the maxillary cast on the articulator. The casts were mounted on the articulator.[1,4,5]

TEETH SELECTION AND ARRANGEMENT OF POSTERIOR TEETH

Semi-anatomic crossed linked acrylic teeth narrower than the existing teeth were selected to avoid pressure on the posterior ridges. Teeth were arranged to provide multiple bilateral posterior contacts in centric relation.

Posterior Try-in

Denture adhesive was used for proper adaptation of denture bases for errorless try-in. The posterior try-in was taken to verify the correct vertical and centric relation records and comfort of the dentures was also checked (Figs 8 and 9). Patient was shown the try-in and informed that the anterior try-in would not be possible due to the presence of the anterior teeth.

Fig. 6: Maxillary final impression

Fig. 7: Mandibular final impression

Fig. 8: Posterior try-in right side

Fig. 9: Posterior try-in left side

SELECTION AND ARRANGEMENT OF ANTERIOR TEETH

The existing teeth were unesthetic in appearance and disproportionate with the face of patient. The anterior teeth were selected to suit the patient's age sex and personality. As the anterior teeth required to be repositioned, the teeth were scrapped from the cast on one side of the arch and gross reduction of the cast was done to recontour the anterior ridge (Fig. 10). Teeth were arranged on one side, and later, the same procedure was carried out on the other side to complete the anterior arrangement (Fig. 11). Wax up was done for both upper and lower arches. The waxed-up dentures were removed from the cast; alginate impressions of both the upper and lower casts were made, poured in dental stone, and casts were obtained. Surgical templates were fabricated on these casts with vacuum form sheet for the surgical procedures (Fig. 12). The waxed-up denture were placed back and sealed on the casts. Flasking, packing, and curing was done in the conventional manner. After proper finishing and polishing, dentures were stored in germicidal solution of 0.2% chlorhexidine and thoroughly rinsed with water prior to insertion.[6]

Denture Insertion Procedures

Presurgical medications were prescribed to patient 1 day prior to surgery. Early appointment was given and she was prepared for the surgery. Adequate local anesthesia was given and the maxillary anterior teeth were removed with minimum trauma. The clear surgical template was used during surgery for evaluation of the prepared surgical site and sutures were given (Fig. 13). The same procedure was also repeated for mandibular arch. After the surgical procedure was completed, the dentures were placed one at a time and evaluated for in retention and stability. After placing both the dentures, occlusion was checked and interferences were removed

Fig. 10: Scrapping of anterior teeth on cast

Fig. 11: Arrangement of anterior teeth

Fig. 12: Surgical templates

Fig. 13: Placement of surgical template after extraction of teeth

Fig. 14: Preoperative

Fig. 15: Postoperative after immediate denture insertion

Fig. 16: Postoperative after conventional complete denture insertion

by selective grinding. The tissue conditioner was used for upper denture for better retention, as the gross amount of bone was reduced in the maxillary anterior region.[1,5,6]

Postinsertion Care

The postoperative instructions were given to the patient. The patient was advised to apply cold packs for the next 1 hour. She was told to wear the denture for the next 24 hours without removing it and avoid expectoration. She was also advised to take liquid diet till the next appointment and to continue the medications. Patient was recalled after 24 hours; dentures were removed, cleaned, and kept in 0.2% chlorhexidine. The tissues were evaluated for any irritation and pain; required modifications in the denture were carried out. Tissue surfaces of the oral cavity were irrigated with 0.2% chlorhexidine mouthwash. Instruction was given to the patient to remove the dentures as minimum number of times as possible for the next 48 hours. The patient was instructed to clean the denture at each meal. She was also instructed to wear the denture at night for 3 days. After 1 week, the patient was recalled and the suture was removed. Patient was kept under regular follow-up. After 4 months, the patient was recalled for evaluation. Dentures were having poor retention; therefore, it was decided to fabricate a new set of complete denture.[1,2,6-8] Astringent gum massage was prescribed to the patient for toughening of the tissues. When all soft and hard tissues were in healthy condition, the procedure for conventional complete denture was started and a new set of upper and lower denture was fabricated. The dentures were inserted in patient's mouth and checked for retention, stability, comfort, and occlusion. Patient was happy and satisfied with the outcome of the denture.

DISCUSSION

A young female patient requiring immediate replacement of all her teeth without going through the period of edentulousness; an immediate complete denture was planned and fabricated for fulfilling patient's desire and need. Patient was already explained that the immediate complete denture is considered as an interim prosthesis and should be relined or possibly a new set of dentures may be required to be fabricated within 6 months.

While fabricating the immediate denture, excess treaming of the cast was required to be carried out, as the teeth were severely proclined. The surgical templates acted as a guide for the surgeon to recontour the bone during extraction of teeth.

Optimal retention, support, and stability for any removable prosthesis are important factors in treatment, success, and patient's comfort.[2] Four months later, patients' complains of poor retention were addressed while fabricating a new set of dentures. Being one of the most important disadvantages of unpredictable esthetics as there was no try-in, the denture esthetics was not as good as that was expected. In addition to that as healing progressed, there was lack of adaptation, retention, and stability of the denture. Patient felt uncomfortable and was unhappy with the outcome of denture. Therefore, the decision was made to fabricate a definitive conventional complete denture.[1,2,6-8] The patient was advised astringent gum massage for tissue toughening. When all soft and hard tissues were in a healthy condition, the procedures for conventional complete denture were started and a new set of maxillary and mandibular complete dentures was fabricated in a conventional manner. Patient was happy with the final outcome of dentures.

Immediate denture is a good option for the patient facing the edentulous state that provides restoration of esthetics, phonetics, and masticatory function. The patient did not have to endure a long healing process without teeth; it also facilitates the transition to the edentulous state. Proper follow-up care is essential for the success of an immediate denture.

CONCLUSION

An immediate complete denture in this case has not only achieved good esthetics but also improved functions within the physiologic limit of the tissues. An immediate complete denture is a treatment option for the patient who seeks for complete teeth to be replaced but not willing to go for complete edentulousness.

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CASE REPORT

Adenomatoid Odontogenic Cyst: A Rare Case Report

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ABSTRACT

Adenomatoid odontogenic cyst (AOC) is a benign, slow growing, relatively uncommon lesion of odontogenic origin. Histogenesis of AOC is still uncertain; however, it is often considered as a hamartomatous lesion rather than a true neoplasm. It is described as a cyst that has a hamartomatous intraluminal proliferation of epithelial cells derived from Hertwig's epithelial root sheath. It usually presents as an expansile lesion in maxillary anterior region. Adenomatoid odontogenic cyst is characterized histopathologically as well-demarcated cysts that typically appear with intraluminal masses. In the present paper, we report a rare case of AOC, thereby emphasizing the terminology and the histoarchitectural spectrum.

Keywords: Adenomatoid odontogenic cyst, Hamartoma, Hertwig's epithelial root sheath, Odontogenic.

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INTRODUCTION

Adenomatoid odontogenic cyst (AOC) is a benign, slow growing, relatively uncommon lesion of odontogenic origin.[1] Adenomatoid odontogenic cyst accounts for about 1 to 9% of all odontogenic lesions. It is best considered as a hamartomatous proliferation rather than neoplasm.[2] It is known to arise from Hertwig's epithelial root sheath as a hamartomatous intraluminal proliferation of epithelial cells.[3] The lesion is most frequently encountered in the second decade of life (68.6%) and 53.1% of cases occur within 13 to 19 years of age. It has a female predilection in almost 2:1 ratio.[1] The cyst presents as an expansile lesion most commonly in the anterior maxillary region.[3] The lesion is asymptomatic but may cause cortical expansion and displacement of the adjacent teeth. Adenomatoid odontogenic cyst is usually associated with an impacted tooth, most often involving unerupted permanent canine.[1,2]

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In the present paper, we report a case of AOC in anterior maxillary region, thereby emphasizing the terminology and the histoarchitectural spectrum.

CASE REPORT

A 19-year-old male patient presented at our institute with a firm, nontender swelling of right maxillary region, since 1 month (Fig. 1). The patient was under medication for epilepsy since past 10 years. The lesion presented as a diffuse swelling extending superoinferiorly from the infraorbital region to alae of right nasal cavity and anteroposteriorly till the zygomatic process. Intraorally, a diffuse swelling was observed extending from 11 to 15 region obliterating the buccal vestibule (Fig. 2). Orthopantomography (OPG) showed radio-opacity in relation to maxillary sinus with over retained 53 and impacted 13. Computed tomography showed a well-defined radiolucency with spicules of radiopaque structure and the associated impacted tooth. Obliteration of maxillary

Fig. 1: Extraoral view shows diffuse swelling extending over the right maxillary region

Fig. 2: Intraoral view shows diffuse swelling extending from 11 to 15, obliterating the buccal vestibule

Fig. 3: Computed tomography shows well-defined radiolucency with spicules of radiopaque structure and the associated impacted tooth. Obliteration of maxillary sinus was also observed

sinus was also observed (Fig. 3). A provisional diagnosis of dentigerous cyst was given.

Incisional biopsy of the lesional tissue microscopically revealed, multinodular proliferation of spindle, cuboidal, and columnar cells in a variety of patterns comprising of rossettes, scattered duct-like structure, hyaline ring, and calcifications with few areas of hemorrhage (Fig. 4). A diagnosis of adenomatoid odontogenic tumor (AOT) was made. Surgical enucleation was done (Fig. 5). The gross excised specimen received was white to black in color measuring 3.0 × 3.0 × 2.0 cm. The lesion was firm in consistency, giving a cystic sac appearance with an irregular surface contour. Microscopically, a cystic space surrounded by thin nonkeratinized stratified squamous epithelial lining of two to three-cell thickness was seen

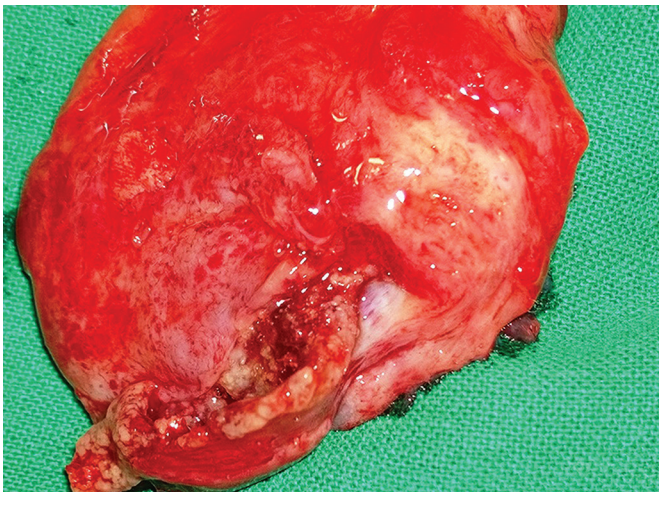

Fig. 5: Surgically enucleated specimen

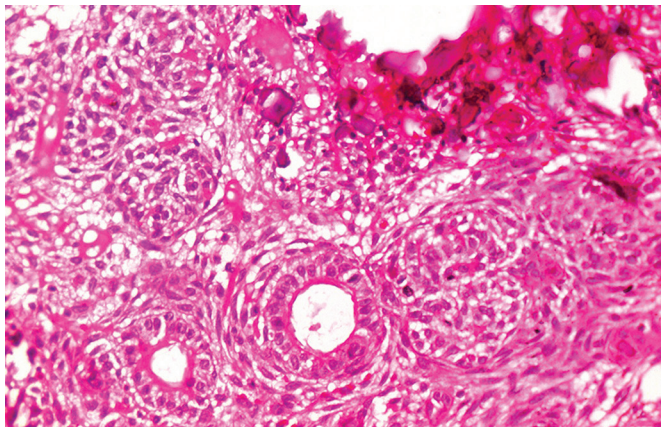

Fig. 4: H&E (400×) stained soft tissue section shows duct-like spaces lined by tall columnar cells with polarized nuclei. Few foci of calcifications are also noticed

(Fig. 6). A cribriform pattern of the epithelial lining was evident at places. Lace-like pattern of proliferating epithelium was also observed with juxta-epithelial hyalinization (Fig. 7). A focal area pathognomonic of AOT was also observed (Figs 8 and 9). The histopathological features confirmed the diagnosis of AOC.

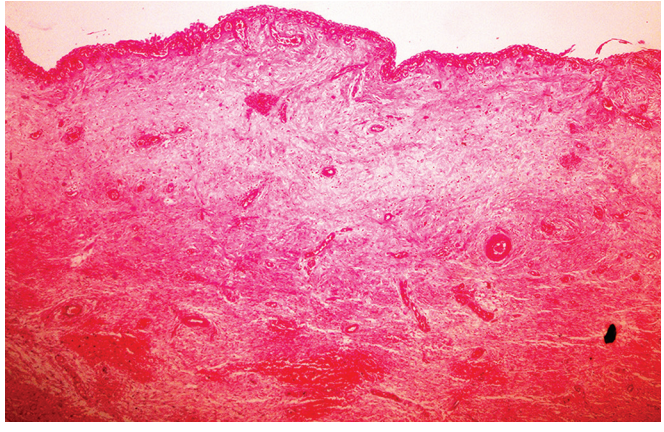

Fig. 6: H&E (40×) stained soft tissue section shows cystic space lined by a thin nonkeratinized stratified squamous epithelial lining of two to three-cell thickness

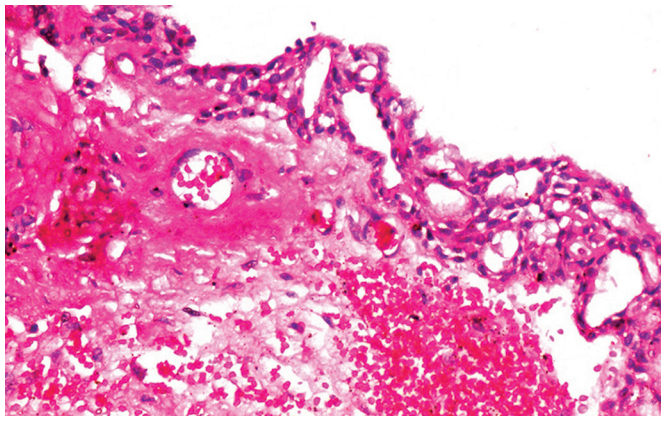

Fig. 7: H&E (100×) stained soft tissue section shows lace-like pattern of proliferating epithelium with juxta-epithelial hyalinization

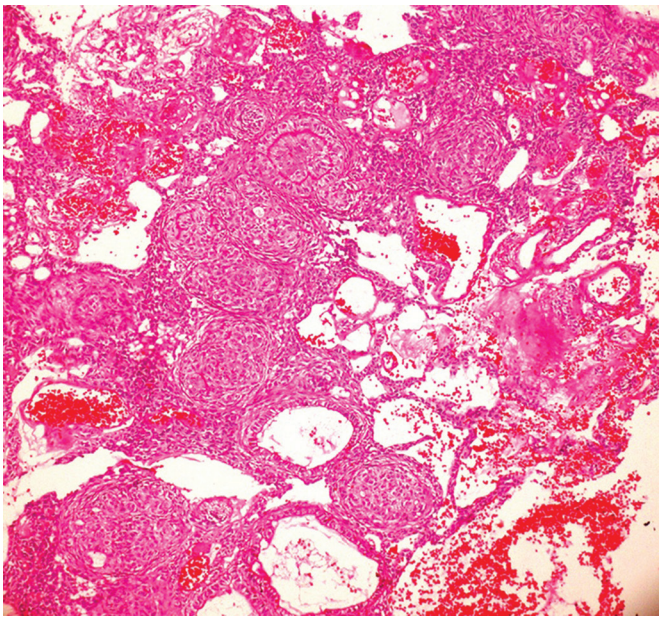

Fig. 8: H&E (100×) stained soft tissue section shows multinodular proliferation of spindle, cuboidal, and columnar cells in a variety of pattern comprising of rossettes, whorls, and scattered duct-like structure

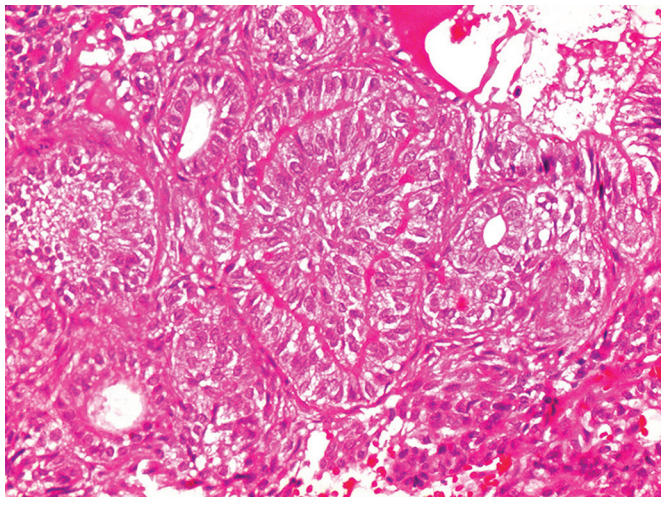

Fig. 9: H&E (100×) stained soft tissue section shows rosette and scattered duct-like structure

DISCUSSION

The term AOC has been proposed by Marx and Stern. They have described the lesion as a hamartomatous intraluminal proliferation of the epithelial cells derived from Hertwig epithelial root sheath (HERS), which fills the cystic space, giving a solid appearance. It has also been referred to as two-thirds tumor as about two-thirds occur in maxilla, two-thirds occur in young women, two-thirds are associated with unerrupted tooth, and two-thirds of those unerrupted teeth are canine.[3] Regezi et al[4] described the lesion as an intracystic epithelial proliferation composed of polygonal and spindle cells. Although cystic presentation of AOT has been reported way back in 1915 by Harbitz who reported the lesion as "cystic adamantoma," a systematic review of literature, however, reveals very few cases.[5] Gadewar et al[6] described a similar cystic presentation and diagnosed it as cystic AOT. Kurra et al[7] in their case report of AOC designated it as a hamartomatous odontogenic cyst. Uppada et al[8] reported a case of AOC that was earlier misdiagnosed as a dentigerous cyst on incisional biopsy.

Microscopically, AOCs are well-demarcated cysts that typically appear with intraluminal or even intramural proliferating masses.[3] The cystic space is usually lined by 3 to 10-cell thick nonkeratinized stratified squamous epithelium that might exhibit nodule formation. The cystic lining may also show focal areas giving origin to strands of smaller cuboidal cells going into the connective tissue in a lace-like pattern. The juxta-epithelial connective tissue shows hyaline material, surrounded by a vascular stroma.[6] The epithelial cells may exhibit a bimorphic appearance with spindle-shaped cells and cuboidal or columnar cells. The spindle-shaped cells may form sheets, strands, or whorled nodules and rossettes. Areas of duct-like spaces lined by a single layer of tall columnar cells with polarized nuclei may also be evident. Calcifications of varying degrees are present and may occur in small droplets. These calcifications may resemble dentin or cementum that would further confirm AOC's histogenesis from Hertwig root sheath.[3] Our case was in accordance to similar microscopic features.

Adenomatoid odontogenic cyst should be included in the differential diagnosis of corticated radiolucency with small radiopaque foci.[2] Radiographically, the cyst appears well-demarcated, unilocular radiolucent lesion and may contain fine calcification. They are usually associated with an impacted tooth. Frequent displacement of roots of adjacent teeth may also be observed but irregular root resorption is rare. Adenomatoid odontogenic cysts that appear without radiographic evidence of calcification will be most suggestive of the more common dentigerous cyst. Adenomatoid odontogenic cyst is known to arise from Hertwig's epithelial root sheath, whereas dentigerous cyst arises from follicle of tooth crown. This explains the attachment of cystic lining of AOC on root surface completely enveloping the tooth, whereas in dentigerous cyst, the attachment is at clinical attachment level (CEJ).[3] Gadewar et al[6] suggested that absence of ameloblast-like cells and ameloblastoma-like proliferation in the lining epithelium could exclude the possibility of unicytic ameloblastoma. Adenomatoid odontogenic cyst in which calcifications can be observed resemble a calcifying odontogenic cyst (COC). The presence of ghost cells, characteristic of COC, is distinctive for the differentiation.[6]

Adenomatoid odontogenic cyst is considered to be a slowly growing benign lesion; hence, a conservative surgical enucleation or curettage is sufficient. The lesion is encapsulated by a thick connective tissue capsule that readily separates from its bony crypt and hence recurrences are rare.[3] However, Xiang and Yan,[9] in their review of 16 cases, reported one case that recurred twice over a period of 20 years. Gadewar et al[6] in their review have also reported four cases of recurrences. Although the prognosis is considered excellent, regular follow-up is necessary.[2] Our case was treated with surgical enucleation with no recurrence reported in 2 years follow-up period.

CONCLUSION

Herein, the goal of this paper is to add on one more case of this rare entity to the literature. The rarity of AOC may be associated with its slowly growing pattern and benign behavior. Therefore, it should be always distinguished from more common lesions of odontogenic origin in routine dental examination. Also, uncommonness of such cases hinders any lasting conclusions regarding the lesions behavior. Thus, it necessitates a periodic review of these cases so as to understand the actual incidence, biological behavior, and outcome associated.

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